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Consumer Quality, Composition, Yield, and Preparation Time of Various Market Forms

Home Economics Research Report No. 22

Agricultural Research Service
UNITED STATES DEPARTMENT OF AGRICULTURE

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SUMMARY

Preparation time and yield were determined for 106 homemade and commercial forms of baked products, including breads, cakes, pies, cookies, and frostings. Objective measurements of compressibility and shear force were determined for 87 baked products.

Proximate composition of homemade and commercial forms of baked products was determined for 72 ready-to-serve, 21 ready-to-bake, and 62 dry-mix items. In addition, eight mineral elements were determined on nine cake and brownie mixes, by using emission spectroscopy.

Commercial forms of baked products saved active time (time requiring constant attention) and, except for some frozen products and a few mixes, saved total time for food preparation. Mixes saved less active preparation time than did other commercial forms of baked products.

Compressibility measurements on cakes, corn muffins, and yeast rolls prepared from mixes were usually higher, an indication of greater softness, than those on other processed or homemade forms of these products.

Shear-force readings on baking powder biscuits, sugar cookies, pie crusts, pancakes, and waffles varied considerably among the forms; i.e., frozen, mix, or homemade. Cookies baked from some mixes and from refrigerated (chilled in roll) dough, and pancakes and waffles made from mixes were more tender than the corresponding homemade products. The frozen form of waffles or pancakes was consistently less tender than other forms investigated, but frozen baking powder biscuits, when baked, were equal to the homemade biscuits in tenderness.

Commercial products were usually higher in moisture and ash, and lower in fat, protein, and energy value than the corresponding homemade items. With few exceptions, proximate composition of dry mixes varied little among brands or over the period of time covered by the study for the same brand of a given mix type. Frostings from frozen and bakery cakes were equal to or greater than the cakes in fat, carbohydrate, and caloric values per 100 grams.

Although whole pies lost weight through evaporation losses during baking and cooling, the crust gained in weight and moisture content because of release of moisture from the filling. For most other ready-to-bake items, moisture losses during cooking were usually between 20 and 30 percent, with accompanying smaller increases in values of other proximate components.

Spectrographic analyses for minerals in dry cake or brownie mixes indicated that baked products made from the mixes contained approximately the same levels of calcium and phosphorus, and two-thirds the amounts of sodium and potassium, of corresponding homemade items.

PURPOSE OF THE INVESTIGATION

Baked products are a prominent part of the diet of most Americans. Three out of four homemakers in the United States in 1955 baked cake, pie, or some kind of quick bread each week (*12*).[1] A substantial number of these homemakers baked their products from mixes. The success of such mixes in receiving consumer acceptance has en-

[1] Italic numbers in parentheses refer to Literature Cited, p. 39.

couraged manufacturers to make available even more partly prepared forms of baked goods. Frozen and chilled dough forms of baked products, in particular, are becoming increasingly available.

The consumer is being forced constantly to select from the various commercial forms of baked goods. Information on relative preparation times, yield, cost, and quality of homemade and commercial forms of baked goods is needed, so that she can choose intelligently in terms of time and money and of the eating quality of the foods. Information on nutrient content is also needed, since the different forms are not necessarily equal in nutritive value.

More and more special ingredients are used in mixes and in commercially prepared products to prolong shelf life, improve baking performance, and maintain constant quality levels. Additives permit changes in the standard proportion of ingredients—the use of emulsifiers may permit reduction in fat content of cake mixes without impairing their functional and eating qualities. Such changes in formulation could possibly result in products that differ considerably from the homemade form in nutritive content.

Studies already reported have been primarily concerned with comparisons of cost and preparation time for homemade and commercially prepared foods. Information on yields, quality measurements, and nutrient composition of the products compared was not usually available. Asp and coworkers (*1*) investigated preparation time and cost of cookies, biscuits, and pie crusts made in the home from ingredients, from homemade mix, and from commercial mix. They found the commercial mix to be the most expensive and to take the least preparation time. Kolmer and Gartner (*7*) reported the time and cost of a variety of foods including baked products such as cookies, pies, cakes, biscuits, and hot rolls. Of the forms of hot rolls investigated in their research, the frozen form required the longest preparation time. In all other baked products, the homemade form required the longest preparation time and, in most cases, was the least expensive.

Weiss (*14*) compared the cost, preparation time, and acceptability of three typical meals daily. These meals were prepared by two persons (one in the home and one in the laboratory) from basic ingredients, from partly prepared foods, and from ready-to-serve foods. She concluded that much time was saved in using prepared foods, compared with the added cost, and that meals made from partly prepared products were nearly as acceptable as the homemade.

A pilot study conducted by the Agricultural Marketing Service on cost to consumers of convenience foods (*5*) revealed that of 52 foods studied, 28 were more expensive, 18 were less expensive, and 6 were the same price as the corresponding unserviced food. The foods investigated were meats, fish, fruits, vegetables, dairy products, and groceries. The average difference in cost per purchase unit of the convenience items as compared with the unserviced form was 0.7 cent.

Pancake or waffle mix and cake mix were the two mixes most frequently used in large cities of the United States in 1953 (*8*). In another study reported in 1957, from 36 to 86 percent of the families interviewed used cake, pudding, pancake, yeast roll, pastry, icing, cookie, muffin, and biscuit mixes at least occasionally (*11*).

The present research was conducted to ascertain the consumer quality, preparation time, yield, and proximate composition of frequently used baked products in different forms available on the retail market. Minerals were determined on selected foods. The study was made by the Human Nutrition Research Division, Agricultural Research Service, in cooperation with the Marketing Economic Division, Economic Research Service. That group provided the samples for the analyses and obtained information on retail food prices. Research on cost comparisons of these foods will be published by the Economic Research Service in a Marketing Research Report.

TYPES OF FOODS INVESTIGATED

The homemade form and two brands each of most purchased partly prepared and already prepared forms of baked products were included in this study. The foods investigated were:

Cakes—angel food, devil's food, pound, and yellow.

Cookies—brownies and sugar cookies.

Pies—apple, cherry, and coconut.

Breads—biscuits, corn muffins, pancakes, waffles, and yeast rolls.

Frostings—chocolate (butter-cream) and white (7-minute).

The homemade baked products were made from household formulas taken from the files of the Human Nutrition Research Division. Ingredients used in homemade products and in mixes are listed in tables 1 to 5. The partly prepared foods were purchased in various forms—both chemically leavened and yeast-leavened refrigerated dough, frozen, brown-and-serve, and mix. Mixes, which require some preparation before baking or cooking, were classified into the following groups:

Type I—water to be added.

Type II—milk to be added.

Type III—more than one ingredient to be added; i.e., eggs and water or milk as in cake mixes.

Ready-to-serve "bakery" foods were purchased from grocery stores and included both nationally advertised and regional brands. The dry mixes,

frozen items, and refrigerated doughs analyzed were nationally advertised brands, and were considered representative of items available in most sections of the United States.

The preparation data—time, yield, and quality measurements—are average values for duplicate samples in many instances; composition data are values for one purchase lot for a preparation form. No attempt was made to analyze enough samples of any one brand of a commercial form to obtain statistically significant average values. Rapid technological changes of factory-prepared foods, resulting in frequent changes in formulation of these products, could quickly make obsolete any statistical differences obtained. Therefore, several brands of a preparation form and a fairly large number of preparation forms were studied, and the number of replications for any one brand or preparation form was limited. General differences among preparation forms (i.e., frozen and dry mix) and variations among brands were observed.

A total of 106 foods was investigated for preparation time and yield, 87 of which were evaluated by objective measurements. For proximate composition, 72 ready-to-serve, 21 ready-to-bake, and 62 dry-mix items were analyzed.

LABORATORY PROCEDURES AND ANALYTICAL METHODS

Preparation Time, Yield, and Quality Measurements

Preparation of Foods

All samples were prepared in a laboratory with temperature and relative humidity controls set at 74° F. and 60 percent, respectively. All weights were recorded in grams and converted to ounces.

Manufacturer's directions for preparation of commercial forms of foods were followed without deviation. Identical pans were used for baking the mix and homemade forms. Other commercial forms were purchased in the largest units available. Many forms, however, were available in only one market size.

Equal weights of dough or batter were used for the mix and homemade forms of corn muffins and yeast rolls. Equal volumes of batter for the different forms were used in baking pancakes and waffles. Batters were divided equally between two pans for homemade pound cakes and for two-layer cakes; in all other cases, the batter was poured into one baking pan. Baking powder biscuits were rolled between sheets of wax paper to ½-inch thickness. Pie crusts were rolled to $\frac{3}{32}$-inch thickness because some pie doughs were too tender to handle when rolled to one-sixteenth inch.

Preparation Time

Preparation time was recorded as active time and total time. Active time was defined as the time for preparation which required constant attention of the laboratory worker, including time for assembling ingredients and equipment, but not for cleanup. Total time was active time plus the waiting time required for thawing, freezing, chilling, baking, or cooking of the foods. For comparability, the same laboratory worker prepared all similar foods.

Yield

Total yield was determined by weight and by volume. Number and size of servings were calculated from the cooked weight and volume by using the weight and volume of a single serving of the homemade food as the reference. The size of servings for the various products was based on information in the literature. Some of the reference sizes of servings for this research were—

8-inch cake	¼ sector.
9-inch cake	1/16 sector.
8½-inch loaf cake	½-inch slice.
8-inch pie	⅙ sector.
7-inch waffle	1.
4-inch pancakes	3.

Pies were separated into crusts and fillings and each was weighed and measured. Frostings were removed from cakes before weights for yields were determined.

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TABLE 1.—CAKES: *Ingredients used in homemade formulas and ingredients added to mixes* [1]

Name and form of product	Formula		
	Ingredients	Weight	Proportion of total weight of ingredients
Angel food:		*Ounces* [2]	*Percent*
Homemade	Egg whites	13. 0	41. 3
	Sugar	13. 1	41. 6
	Flour (cake)	5. 0	15. 9
	Cream of tartar	. 2	. 6
	Salt	. 1	. 3
	Almond flavoring.	. 1	. 3
	Total	31. 5	100. 0
Mix (Type I):			
Brand A	Mix	16. 0	61. 5
	Water	9. 9	38. 1
	Almond flavoring.	. 1	. 4
	Total	26. 0	100. 0
Brand B	Mix	16. 0	61. 0
	Water	9. 9	37. 8
	Vanilla	. 2	. 8
	Almond flavoring.	. 1	. 4
	Total	26. 2	100. 0
Devil's food:			
Homemade	Fat	4. 0	10. 8
	Sugar	10. 5	28. 5
	Eggs	3. 4	9. 2
	Flour (cake)	6. 7	18. 2
	Baking powder (SAS/P).	. 2	. 5
	Soda	. 1	. 3
	Salt	. 1	. 3
	Chocolate (unsweetened).	3. 0	8. 1
	Buttermilk	8. 7	23. 6
	Vanilla	. 2	. 5
	Total	36. 9	100. 0
Mix (Type III):			
Brand A	Mix	18. 9	58. 7
	Eggs	3. 4	10. 6
	Water	9. 9	30. 7
	Total	32. 2	100. 0
Brand B	Mix	20. 0	63. 7
	Eggs	3. 4	10. 8
	Water	8. 0	25. 5
	Total	31. 4	100. 0
Pound:		*Ounces* [2]	*Percent*
Homemade	Butter	10. 0	24. 3
	Sugar	10. 5	25. 5
	Eggs	10. 4	25. 2
	Flour (cake)	10. 0	24. 4
	Salt	. 05	<. 1
	Vanilla	. 2	. 5
	Total	41. 2	100. 0
Mix (Type III):			
Brand A	Mix	16. 9	69. 5
	Eggs	3. 4	14. 0
	Water	4. 0	16. 5
	Total	24. 3	100. 0
Brand B	Mix	18. 0	64. 8
	Eggs	3. 4	12. 2
	Milk	6. 4	23. 0
	Total	27. 8	100. 0
Yellow:			
Homemade	Butter	1. 3	5. 0
	Fat	1. 1	4. 2
	Sugar	7. 0	27. 0
	Eggs	3. 4	13. 1
	Flour (cake)	6. 7	26. 0
	Baking powder (SAS/P).	. 4	1. 5
	Milk	5. 8	22. 4
	Salt	. 1	. 4
	Vanilla	. 1	. 4
	Total	25. 9	100. 0
Mix (Type III):			
Brand A	Mix	18. 0	56. 6
	Eggs	3. 4	10. 7
	Water	10. 4	32. 7
	Total	31. 8	100. 0
Brand B	Mix	19. 0	62. 5
	Eggs	3. 4	11. 2
	Water	8. 0	26. 3
	Total	30. 4	100. 0

[1] Type I mix requires water, and Type III mix requires eggs and other ingredients.
[2] Weight was recorded in grams and converted to ounces.

TABLE 2.—COOKIES: *Ingredients used in homemade formulas and ingredients added to mixes* [1]

Name and form of product	Formula			Name and form of product	Formula		
	Ingredients	Weight	Proportion of total weight of ingredients		Ingredients	Weight	Proportion of total weight of ingredients
Brownies:		*Ounces* [2]	*Percent*	Cookies, sugar (refrigerated):		*Ounces* [2]	*Percent*
Homemade	Chocolate (unsweetened)	2.0	8.3	Homemade	Butter	4.0	22.2
	Fat	4.0	16.7		Vanilla	.2	1.1
	Sugar	7.0	29.2		Sugar	5.2	28.9
	Eggs	3.4	14.2		Eggs	1.7	9.4
	Flour	3.0	12.5		Flour (cake)	6.7	37.1
	Baking powder (SAS/P)	.1	.4		Baking powder (SAS/P)	.2	1.1
	Salt	.1	.4		Salt	.04	.2
	Nuts (chopped)	4.2	17.5				
	Vanilla	.2	.8		Total	18.0	100.0
	Total	24.0	100.0	Mix (Type I)	Mix	13.6	90.1
Mix (Type I)	Mix	10.5	69.1		Water	1.5	9.9
	Water	2.6	17.1				
	Nuts (chopped)	2.1	13.8		Total	15.1	100.0
	Total	15.2	100.0	Mix (Type II)	Mix	11.0	89.5
					Milk	1.1	8.9
Mix (Type III):					Vanilla	.2	1.6
Brand A	Mix	16.0	73.4		Total	12.3	100.0
	Eggs	1.7	7.8				
	Water	2.0	9.2	Mix (Type III):			
	Nuts (chopped)	2.1	9.6	Brand A	Mix	11.0	85.2
	Total	21.8	100.0		Eggs	1.7	13.2
					Vanilla	.2	1.6
Brand B	Mix	16.0	73.4		Total	12.9	100.0
	Eggs	1.7	7.8				
	Water	2.0	9.2	Brand B	Mix	8.9	43.7
	Nuts (chopped)	2.1	9.6		Eggs	1.7	8.4
	Total	21.8	100.0		Milk	2.9	14.3
					Sugar	4.7	23.2
					Fat	1.7	8.4
					Vanilla	.4	2.0
					Total	20.3	100.0

[1] Type I mix requires water, Type II mix requires milk, and Type III mix requires eggs and other ingredients.
[2] Weight was recorded in grams and converted to ounces.

TABLE 3.—PIES: *Ingredients used in homemade formulas and ingredients added to mixes* [1]

Name and form of product	Formula		
	Ingredients	Weight	Proportion of total weight of ingredients
Apple:			
Homemade:		*Ounces* [2]	*Percent*
Crust	Flour	9. 0	49. 2
	Salt	. 3	1. 6
	Fat	6. 0	32. 8
	Water	3. 0	16. 4
	Total	18. 3	100. 0
Dough used.		8. 9	
Filling	Apples	15. 9	71. 0
	Sugar	5. 2	23. 1
	Flour	. 2	. 9
	Salt	. 01	<. 1
	Cinnamon	. 1	. 4
	Nutmeg	. 02	. 1
	Butter	. 5	2. 2
	Lemon juice	. 5	2. 2
	Total	22. 4	100. 0
Total weight of pie.		31. 3	
Mix (Type I pastry, Type III filling):			
Brand A:			
Crust	Mix	9. 5	82. 6
	Water	2. 0	17. 4
	Total	11. 5	100. 0
Dough used.		6. 5	
Brand AA:			
Filling	Apples (dried)	5. 4	21. 6
	Water	16. 0	64. 0
	Sugar	3. 5	14. 0
	Cinnamon	. 04	. 2
	Salt	. 05	. 2
	Total	25. 0	100. 0
Total weight of pie.		31. 5	
Brand B:			
Crust	Mix	10. 0	83. 3
	Water	2. 0	16. 7
	Total	12. 0	100. 0
Dough used.		11. 6	

Name and form of product	Formula		
	Ingredients	Weight	Proportion of total weight of ingredients
Apple—Continued			
Homemade—Con.			
Brand BB:		*Ounces* [2]	*Percent*
Filling	Mix	20. 0	65. 3
	Sugar	10. 5	34. 3
	Cinnamon	. 1	. 3
	Nutmeg	. 02	<. 1
	Total	30. 6	100. 0
Total weight of pie.		42. 2	
Brand C:			
Crust	Mix	10. 0	82. 0
	Water	2. 2	18. 0
	Total	12. 2	100. 0
Dough used.		11. 9	
Brand CC:			
Filling	Mix	20. 0	80. 2
	Sugar	4. 7	18. 9
	Flour	. 2	. 8
	Cinnamon	. 02	. 1
	Total	24. 9	100. 0
Total weight of pie.		36. 8	
Cherry:			
Homemade:			
Crust	Flour	9. 0	49. 2
	Salt	. 3	1. 6
	Fat	6. 0	32. 8
	Water	3. 0	16. 4
	Total	18. 3	100. 0
Dough used.		7. 8	
Filling	Cherries	16. 0	76. 0
	Sugar	3. 5	16. 7
	Cornstarch	. 6	2. 9
	Butter	. 9	4. 3
	Salt	. 03	. 1
	Total	21. 0	100. 0
Total weight of pie.		28. 8	

See footnotes at end of table.

TABLE 3.—PIES: *Ingredients used in homemade formulas and ingredients added to mixes* [1]—Continued

Name and form of product	Formula		
	Ingredients	Weight	Proportion of total weight of ingredients
Cherry—Con.			
Mix (Type I pastry, canned filling):			
Brand A:		*Ounces* [2]	*Percent*
Crust	Mix	9. 5	82. 6
	Water	2. 0	17. 4
	Total	11. 5	100. 0
Dough used.		8. 8	
Brand AA:			
Filling	Mix	22. 0	100. 0
Total weight of pie.		30. 8	
Brand B:			
Crust	Mix	10. 0	83. 3
	Water	2. 0	16. 7
	Total	12. 0	100. 0
Dough used.		9. 1	
Brand BB:			
Filling	Mix	22. 0	100. 0
Total weight of pie.		31. 1	
Coconut:			
Homemade:			
Crust	Flour	4. 2	48. 3
	Salt	. 2	2. 3
	Fat	2. 5	28. 7
	Water	1. 8	20. 7
	Total	8. 7	100. 0
Dough used.		4. 4	
Filling	Eggs	5. 1	17. 6
	Sugar	2. 6	9. 0
	Salt	. 01	. 03
	Vanilla	. 1	. 3
	Milk	19. 5	67. 2
Coconut—Con.			
Homemade—Con.			
Filling—Con.	Coconut (frozen shredded).	*Ounces* [2] 1. 7	*Percent* 5. 9
	Total	29. 0	100. 0
Total weight of pie.		33. 4	
Mix (Type I pastry, Type III filling):			
Brand A:			
Crust	Mix	5. 2	81. 2
	Water	1. 2	18. 8
	Total	6. 4	100. 0
Dough used.		4. 0	
Filling	Mix	5. 3	18. 7
	Egg yolks	1. 4	4. 9
	Milk	21. 7	76. 4
	Total	28. 4	100. 0
Total weight of pie.		32. 4	
Brand B:			
Crust	Mix	5. 0	80. 6
	Water	1. 2	19. 4
	Total	6. 2	100. 0
Dough used.		5. 5	
Brand BB:			
Filling	Mix	2. 2	9. 4
	Milk	19. 6	83. 4
	Coconut (frozen shredded).	1. 7	7. 2
	Total	23. 5	100. 0
Total weight of pie.		29. 0	

[1] Type I mix requires water, and Type III mix requires more than one ingredient to be added.
[2] Weight was recorded in grams and converted to ounces.

TABLE 4.—BREADS: *Ingredients used in homemade formulas and ingredients added to mixes* [1]

Name and form of product	Formula		
	Ingredients	Weight	Proportion of total weight of ingredients
		Ounces [2]	*Percent*
Baking powder biscuits:			
Homemade	Flour	8. 0	46. 8
	Baking powder (SAS/P).	. 3	1. 8
	Salt	. 1	. 6
	Fat	2. 2	12. 8
	Milk	6. 5	38. 0
	Total	17. 1	100. 0
Mix (Type II):			
Brand A	Mix	8. 1	58. 6
	Milk	5. 7	41. 4
	Total	13. 8	100. 0
Brand B	Mix	8. 0	58. 4
	Milk	5. 7	41. 6
	Total	13. 7	100. 0
Corn muffins:			
Homemade	Cornmeal (yellow).	6. 7	29. 3
	Flour	2. 7	11. 8
	Baking powder (SAS/P).	. 4	1. 8
	Salt	. 1	. 4
	Sugar	. 9	3. 9
	Eggs	1. 7	7. 4
	Milk	8. 7	38. 0
	Fat	1. 7	7. 4
	Total	22. 9	100. 0
Mix (Type III):			
Brand A	Mix	14. 0	59. 1
	Eggs	1. 7	7. 2
	Water	8. 0	33. 7
	Total	23. 7	100. 0
Brand B	Mix	8. 5	64. 9
	Eggs	1. 7	13. 0
	Milk	2. 9	22. 1
	Total	13. 1	100. 0
Pancakes:			
Homemade	Flour	6. 0	33. 1
	Baking powder (SAS/P).	. 2	1. 1
	Salt	. 1	. 6
	Sugar	. 4	2. 2
	Eggs	1. 7	9. 4
	Milk	8. 7	48. 1
	Corn oil	1. 0	5. 5
	Total	18. 1	100. 0
Mix (Type I)	Mix	14. 0	46. 7
	Water	16. 0	53. 3
	Total	30. 0	100. 0

Name and form of product	Formula		
	Ingredients	Weight	Proportion of total weight of ingredients
		Ounces [2]	*Percent*
Pancakes—Con.			
Mix (Type II):			
Brand A	Mix	4. 0	26. 1
	Milk	10. 8	70. 6
	Corn oil	. 5	3. 3
	Total	15. 3	100. 0
Brand B	Mix	8. 9	45. 2
	Milk	10. 8	54. 8
	Total	19. 7	100. 0
Mix (Type III):			
Brand A	Mix	4. 0	26. 8
	Eggs	1. 7	11. 4
	Milk	8. 7	58. 4
	Corn oil	. 5	3. 4
	Total	14. 9	100. 0
Brand B	Mix	8. 8	30. 4
	Eggs	1. 7	5. 9
	Milk	17. 4	60. 2
	Corn oil	1. 0	3. 5
	Total	28. 9	100. 0
Waffles:			
Homemade	Flour	6. 0	31. 0
	Baking powder (SAS/P).	. 2	1. 0
	Salt	. 1	. 5
	Eggs	3. 4	17. 5
	Milk	8. 7	44. 8
	Corn oil	1. 0	5. 2
	Total	19. 4	100. 0
Mix (Type I)	Mix	14. 0	46. 7
	Water	16. 0	53. 3
	Total	30. 0	100. 0
Mix (Type III):			
Brand A	Mix	7. 8	31. 2
	Eggs	1. 7	6. 8
	Milk	14. 5	58. 0
	Corn oil	1. 0	4. 0
	Total	25. 0	100. 0
Brand B	Mix	8. 9	36. 9
	Eggs	3. 4	14. 1
	Milk	10. 8	44. 8
	Corn oil	1. 0	4. 2
	Total	24. 1	100. 0
Brand C	Mix	8. 9	31. 4
	Eggs	3. 4	12. 0
	Milk	14. 5	51. 3
	Corn oil	1. 5	5. 3
	Total	28. 3	100. 0

See footnotes at end of table.

TABLE 4.—BREADS: *Ingredients used in homemade formulas and ingredients added to mixes* [1]—Continued

Name and form of product	Formula		
	Ingredients	Weight	Proportion of total weight of ingredients
Waffles—Continued			
Mix—Continued		*Ounces* [2]	*Percent*
Brand D	Mix	4. 4	27. 0
	Eggs	1. 7	10. 4
	Milk	8. 7	53. 4
	Corn oil	1. 5	9. 2
	Total	16. 3	100. 0
Yeast rolls:			
Homemade	Dry yeast	. 3	. 8
	Water	2. 0	5. 5
	Sugar	1. 8	4. 9
	Fat	1. 7	4. 7
	Salt	. 2	. 6
	Milk	8. 7	23. 9
Yeast rolls—Con.			
Homemade—Con.	Eggs	1. 7	4. 7
	Flour	20. 0	54. 9
	Total	36. 4	100. 0
Mix (Type I):			
Brand A	Mix	14. 2	64. 0
	Water	8. 0	36. 0
	Total	22. 2	100. 0
Brand B	Mix	14. 2	64. 0
	Water	8. 0	36. 0
	Total	22. 2	100. 0

[1] Type I mix requires water, Type II mix requires milk, and Type III mix requires eggs and other ingredients.
[2] Weight was recorded in grams and converted to ounces.

TABLE 5.—FROSTINGS: *Ingredients used in homemade formulas and ingredients added to mixes* [1]

Name and form of product	Formula		
	Ingredients	Weight	Proportion of total weight of ingredients
Frosting, chocolate:			
Homemade	Sugar (confectioners).	*Ounces* [2] 9. 0	*Percent* 67. 7
	Fat (table)	2. 0	15. 0
	Chocolate (unsweetened).	2. 0	15. 0
	Milk	. 3	2. 3
	Total	13. 3	100. 0
Mix (Type I):			
Brand A	Mix	5. 5	84. 6
	Water	1. 0	15. 4
	Total	6. 5	100. 0
Brand B	Mix	15. 0	85. 7
	Water	2. 5	14. 3
	Total	17. 5	100. 0
Brand C	Mix	13. 0	76. 4
	Butter	2. 0	11. 8
	Water	2. 0	11. 8
	Total	17. 0	100. 0
Frosting, white:			
Homemade	Egg whites	*Ounces* [2] 2. 0	*Percent* 14. 7
	Sugar	10. 5	77. 1
	Salt	<. 1	. 1
	Corn sirup (light).	. 2	1. 5
	Water	. 7	5. 1
	Vanilla	. 2	1. 5
	Total	13. 6	100. 0
Mix (Type I):			
Brand A	Mix	6. 5	61. 9
	Water	4. 0	38. 1
	Total	10. 5	100. 0
Brand B	Mix	6. 5	65. 0
	Water	3. 5	35. 0
	Total	10. 0	100. 0

[1] Type I mix requires water.
[2] Weight was recorded in grams and converted to ounces.

Quality Evaluation

As an objective method for determining tenderness of angel food cake, devil's food cake, pound cake, yellow cake, corn muffins, and yeast rolls, compressibility was measured by the Precision penetrometer equipped with the flat disk and a number of weights. In order to standardize procedures, compressibility measurements were taken on cakes 18 to 20 hours after baking and on corn muffins and yeast rolls 3 to 4 hours after baking. Depth of penetration in 5 seconds was measured on six samples, each measuring 1¾ x 1¾ x ⅞ inches, with penetrometer weights of 100 grams for angel food cake; 250 grams for devil's food, pound, and yellow cakes and yeast rolls; and 275 grams for corn muffins.

Shear force of biscuits, pancakes, waffles, cookies, and pie crusts was measured on the Warner-Bratzler shear machine (capacity 60 pounds force). Six readings were made on each sample, previously cut into 1¼-inch strips. Readings were taken on pancakes and waffles immediately after baking and on biscuits, cookies, and pie crusts after cooling to room temperature.

Proximate Composition and Mineral Element Analyses

Foods Analyzed

Proximate composition was determined for all preparation forms of each food included in the preparation time and yield investigations. Frostings and fillings analyzed were those removed from frozen and bakery cakes and brownies, and two brands of chocolate frosting dry mix. In many instances, the analyses for proximate composition were made at a later date than were the preparation-time and yield-data determinations. In both, however, the same standardized procedures were followed, the same standard weights of ingredients were added, and the same staff prepared the samples. Composition of some products was obtained for the same brand two or more times over a period of several months to see if formulation changes were reflected by composition changes. For a number of mixes, two packages were purchased from the same lot, one for proximate analyses in the dry form and the other for analyses after preparation and baking. Ten ready-to-bake items were also purchased in duplicate and analyzed both before and after baking.

In addition to proximate composition, content of eight mineral elements was determined in nine cake and brownie mixes, primarily to indicate the amount of leavening agents present.

Sample Preparation

Cakes and frostings, pie crusts and pie fillings, angel food-flour and angel food-egg white mixtures were separated before being analyzed. Dry mixes were stored in tightly covered glass jars and mixed by tumbling before being weighed. Samples other than dry mixes were weighed and stored in sealed cans at −20° C. Before being weighed for analyses, the frozen samples were ground three times in a Hobart mill to pass a plate having holes of 5 mm. diameter.

Moisture

Samples were weighed in shallow 60-mm. aluminum foil dishes and dried overnight at 50° C. in a forced-air oven. Drying was continued to constant weight in a vacuum oven at 50° C. Loss in weight was recorded as the moisture content.

Fat

Representative samples of each food were analyzed for fat both by ethyl-ether extraction of residues from moisture determinations in a Soxhlet apparatus overnight and by the acid hydrolysis procedure of the AOAC (*2*). For coconut pie fillings, which are high in milk, hydrolysis was preceded by digestion with ammonium hydroxide, according to the Roese-Gottlieb method for fat in cheese (*2*). In only a few cases were differences between the two basic methods greater than the experimental error; for those few cases, fat data reported here are the higher values. For samples high in milk, for instance, Roese-Gottlieb fat values are reported, while for samples containing nuts, Soxhlet values are used.

For all other samples, fat was determined by the Soxhlet extraction method.

Protein

Total nitrogen was determined by the microkjeldahl method of the AOAC, modified by using 0.02 *N* HCl rather than boric acid in the distillation step, and by titrating with 0.02 *N* NaOH and the indicator methyl red. Factors for converting total nitrogen values to protein values were calculated from formulas and from yield data, by using the appropriate factors for individual foods established by Jones and reported by Merrill and Watt (*10*).

Ash

Weighed samples, after overnight drying at 50° C. in a forced-air oven, were ashed to constant weight at 600° C. in a muffle furnace.

Food Energy

Calorie conversion factors were calculated in the same manner as the protein factors, by using the energy values established for individual food items (*10*).

Composition of Individual Servings

Yield data (tables 7 through 11) show that standard servings of a product based on volume

frequently varied greatly in weight among the different forms investigated. Proximate values for ready-to-serve and ready-to-bake products, therefore, were calculated and reported not only for basic 100-gram portions but also for individual servings, by using data on equal-volume serving sizes described under "total yield."

Mineral Elements

Seven mineral elements—calcium, copper, iron, magnesium, manganese, phosphorus, and sodium—were determined with the medium spectrograph; potassium was analyzed with the flame photometer. The analytical system used was essentially that of Hopkins et al. (*6*). For the spectrographic determinations, 10- to 15-mg. samples of the dry mixes were weighed directly into the electrodes, ashed, and arced. No preliminary concentrations of the samples were made before weighing. Mineral values reported here are arithmetic means for four determinations on each mix.

RESULTS AND DISCUSSION

Preparation Time, Yield, and Quality Measurements

Preparation Time

The preparation times of commercially processed and homemade foods as determined by the same laboratory worker are reported in graphic form (figs. 1 and 2).

Mixes for devil's food, pound, and yellow cakes saved from 67 to 80 percent of the active time of 30 to 41 minutes required for preparation of the corresponding homemade product and saved from 27 to 48 percent of the total time of 59 to 120 minutes. Mixes for angel food cakes saved somewhat less active and total preparation time. Frozen cakes saved from 88 to 92 percent of the 40 to 41 minutes of active time, but little or no total time since time for thawing was involved. Thawing time, however, does not require close attention. Bakery cakes, of course, required no time for preparation.

Cookies made from mixes sometimes required longer active and total time than did the homemade cookies. The cookie dough made from one brand of mix was sticky and difficult to handle. Total preparation time of cookies, pancakes, and waffles sometimes depends on the quantity prepared at one time since baking is done in lots. When total preparation time included only the time for baking of one cooking lot, preparation times differed considerably less among the forms tested. Preparation time of waffles, for example, required 16 minutes for the homemade form; 7, 9, and 10 minutes for Types I, II, and III mixes, respectively; and 2 and 15 minutes for the two brands of frozen waffles.

Frozen pies saved 96 percent of the active time, and pies made from mixes saved 44 percent of the 41 to 57 minutes required for preparation of the

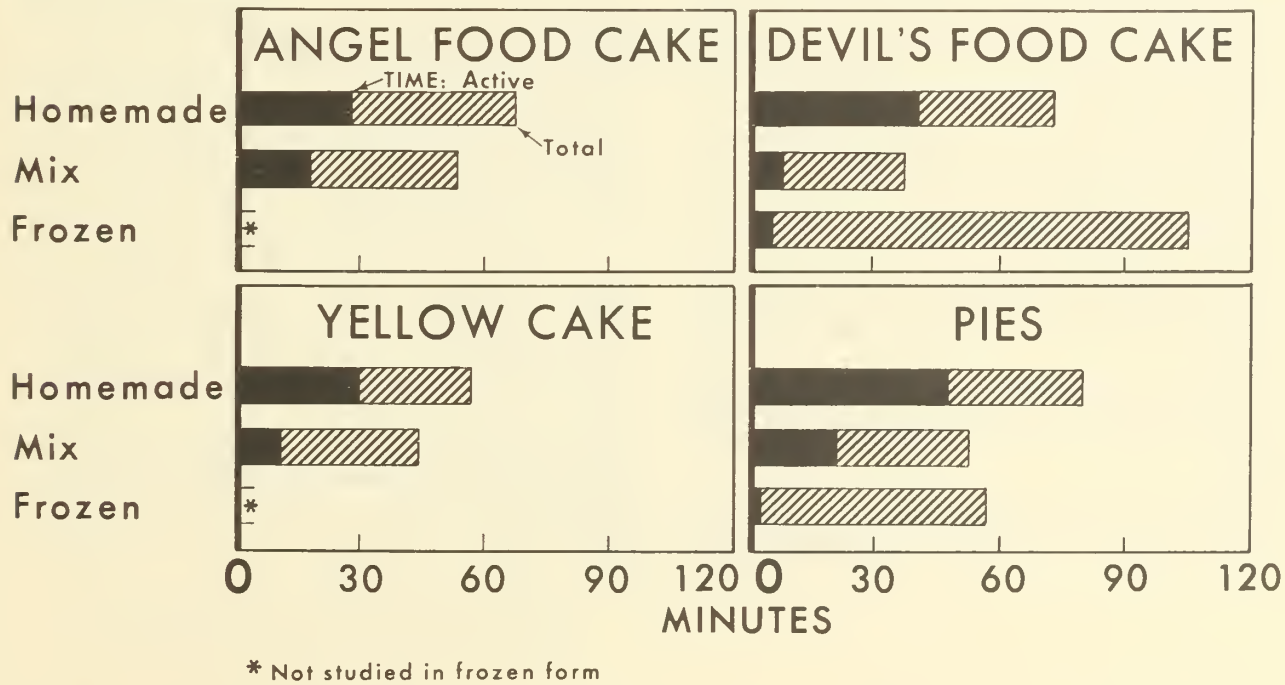

FIGURE 1.—Preparation times, including active and total time, for angel food, devil's food, and yellow cakes, and pies.

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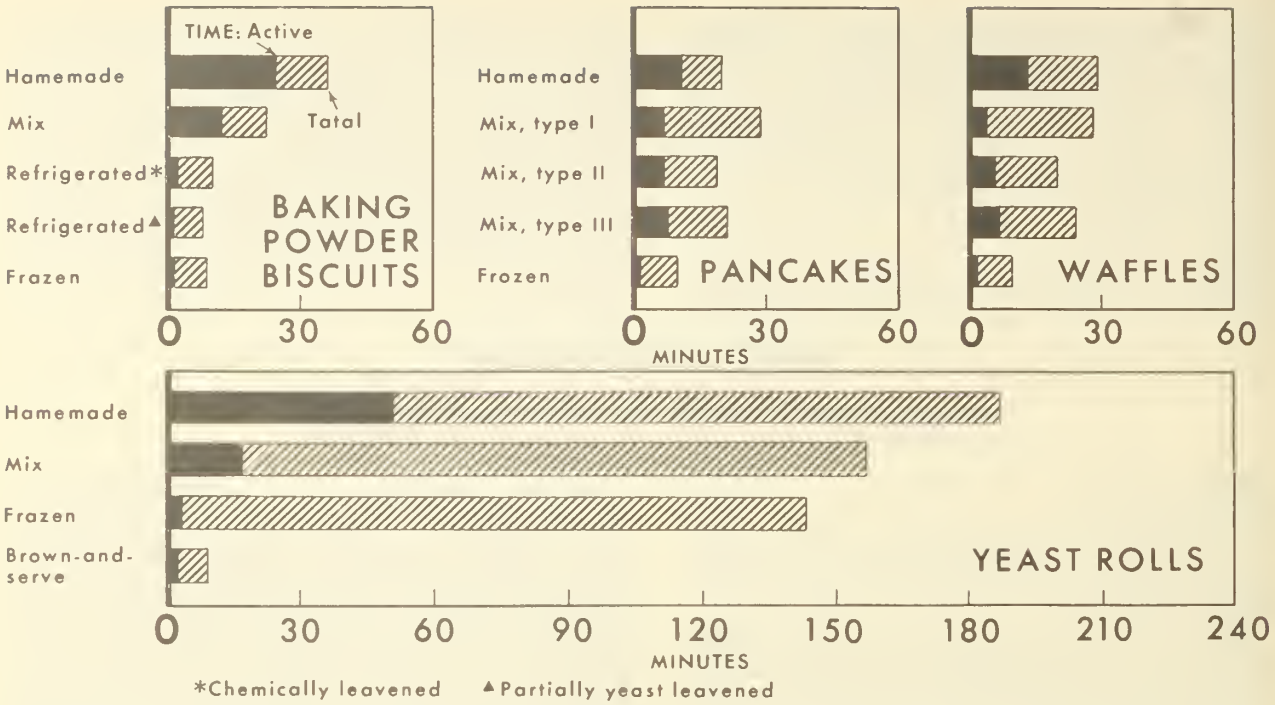

FIGURE 2.—Preparation times, including active and total time, for baking powder biscuits, pancakes, waffles, and yeast rolls.

homemade pies. Both kinds of partly prepared pies afforded a saving of about 30 percent in total preparation time.

Biscuits made from mixes saved 54 percent of the 24 minutes of active time and 39 percent of the 36 minutes of total time required for preparation of the homemade form. The other commercial forms of biscuits saved more than 90 percent of the active time and more than 70 percent of the total preparation time. Corn muffin mixes saved less than 25 percent of the active or total time.

Partly prepared yeast rolls of the mix, frozen, and brown-and-serve forms saved 67, 95, and 96 percent, respectively, of the 51 minutes of active preparation time required for the homemade product. Brown-and-serve rolls saved 95 percent of the total preparation time, and mix and frozen rolls saved less than 25 percent of the 3 hours and 7 minutes required for preparing the homemade product.

Overall preparation times for brownies and frostings made from mixes differed little from those required for preparation of the homemade forms.

Yield

Homemakers, institution managers, and many others responsible for serving food ordinarily portion the size of servings for baked products according to a specified volume rather than to a specified weight. Cost analysts and some marketing specialists, however, compute cost per serving on a weight basis.

The reference sizes of servings for all forms relative to volume and to weight are given in table 6. The total yield and number of servings of baked products are given in tables 7 to 11. The homemade forms usually yielded more servings, both on volume and on weight bases, than did most of the commercial forms prepared. This was to be expected because the formulas for most homemade foods, unlike the purchase unit sizes of many ready-to-serve foods, yield more than just enough servings for one meal. Servings of pies based on weight varied considerably, partially because the ratios of fillings to crusts varied.

Specific volumes (cubic centimeters per gram) of the baked cakes are given graphically in figure 3. Specific volumes were, for most kinds of cake, highest for homemade and mix forms and lowest for bakery forms. The various forms of pound cake, however, differed little in specific volumes.

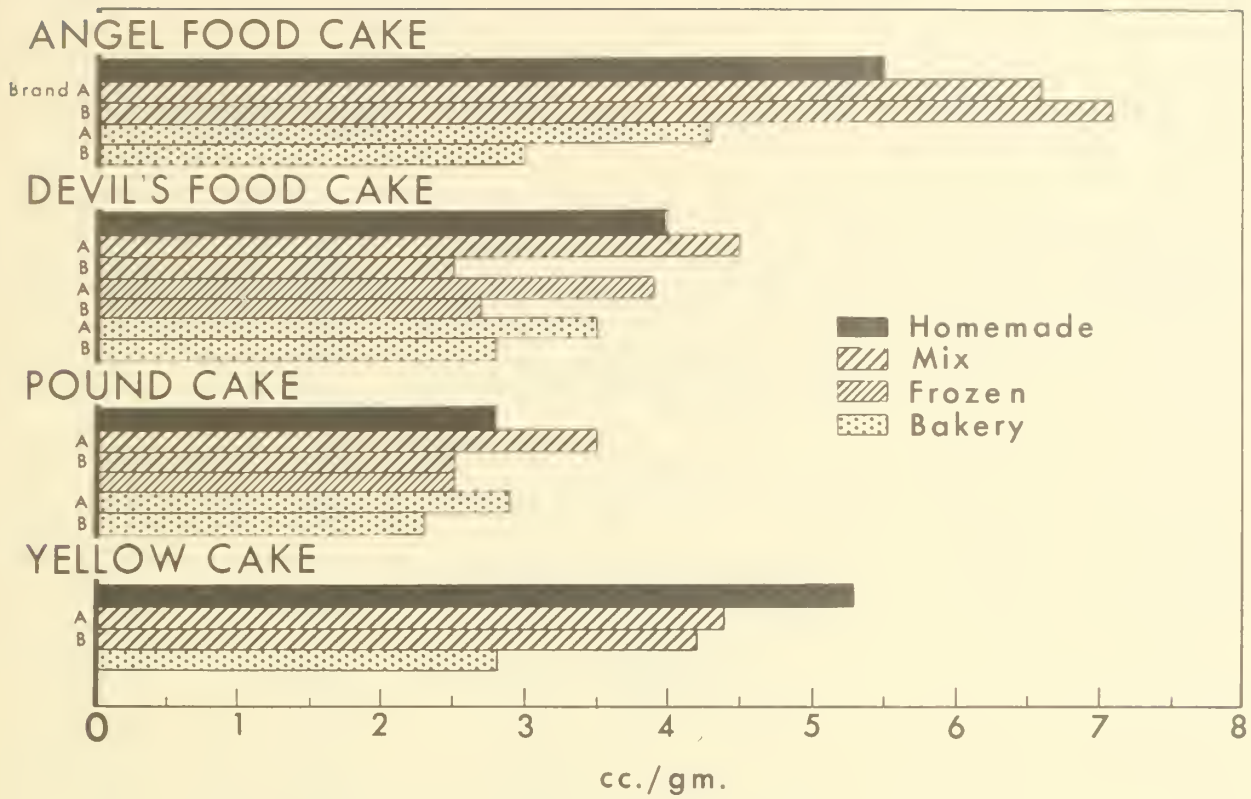

FIGURE 3.—Specific volumes of baked cakes of different market forms.

TABLE 6.—BAKED PRODUCTS: *Reference size of individual servings relative to volume and weight of the homemade product*

Name of product	Size of serving for all forms—		Name of product	Size of serving for all forms—	
	By volume	By weight		By volume	By weight
	Cubic inches	*Ounces*		*Cubic inches*	*Ounces*
Cakes:			Pies—Continued		
Angel food	16. 0	1. 7	Coconut	7. 0	5. 0
Devil's food	12. 0	1. 7			
Pound	5. 2	1. 1	Breads:		
Yellow	11. 5	1. 2	Baking powder biscuits	6. 3	1. 4
			Corn muffins	4. 7	1. 5
Cookies:			Pancakes	8. 3	5. 3
Brownies	2. 4	. 7	Waffles	19. 2	3. 3
Sugar (refrigerated-type)	1. 3	. 5	Yeast rolls	5. 5	1. 3
Pies:			Frostings:		
Apple	7. 0	4. 7	Chocolate (butter-cream)	[1] 1.5 cups	14. 8
Cherry	7. 0	4. 5	White (7-minute)	[1] 2.7 cups	8. 9

[1] Amount needed to cover two 8- or 9-inch layers.

TABLE 7.—CAKES: *Yield and number of servings of homemade, partly prepared, and ready-to-serve forms*

Name and form of product	Preparation month (1959) [1]	Purchase unit	Total yield				
			Measure	Volume	Baked weight	Servings [2]	
						By volume	By weight
		Ounces [3]		*Cu. in.*	*Ounces* [3]	*Number*	*Number*
Angel food:							
Homemade	April		1, 9-inch cake, 4.5 inches high	259	27.4	16.0	16.1
Mix (Type I):							
Brand A	March	16.0	1, 9-inch cake, 4.4 inches high	253	22.2	15.7	13.1
Brand B	October	16.0	1, 9-inch cake, 4.8 inches high	276	22.6	17.1	13.3
Bakery:							
Brand A	do	10.3	1, 6.5-inch cake, 2.4 inches high	76	10.3	4.7	6.1
Brand B	August	12.0	1, 7.5- x 3.5-inch loaf, 2.2 inches high.	58	11.1	3.6	6.5
Devil's food:							
Homemade	May		2, 9-inch layers, 3.0 inches high	191	27.8	16.0	16.4
Mix (Type III):							
Brand A	do	19.0	2, 9-inch layers, 3.2 inches high	204	26.2	17.1	15.4
Brand B [4]	August	20.0	2, 9-inch layers, 2.0 inches high	128	28.5	10.1	16.8
Frozen:							
Brand A	March	18.0	2, 7-inch layers, 1.6 inches high	62	[5] 9.0	5.2	5.3
Brand B [4]	August	18.0	1, 7.5-inch layer, 1.2 inches high	54	[5] 11.4	4.6	6.7
Bakery:							
Brand A	May	13.5	2, 7.3- x 4.9-inch rectangle, 2.0 inches high.	72	[5] 12.0	6.2	7.1
Brand B	March	14.5	2, 6.6- x 3.7-inch rectangle, 2.4 inches high.	59	[5] 10.9	4.9	6.4
Pound:							
Homemade	July		2 loaves, 8.5 x 3.5 x 3.0 inches	178	36.9	34.0	33.5
Mix (Type III):							
Brand A	do	17.0	1 loaf, 8.5 x 4.5 x 3.5 inches	134	22.1	25.5	20.1
Brand B	do	17.0	1 loaf, 8.5 x 3.5 x 3.5 inches	104	24.1	19.8	22.0
Frozen	do	12.2	1 loaf, 8.0 x 3.1 x 2.2 inches	54	12.2	10.4	11.0
Bakery:							
Brand A	do	16.0	1 loaf, 8.0 x 3.5 x 2.8 inches	78	15.5	14.9	14.0
Brand B [4]	do	14.0	1 loaf, 4.8 x 3.9 x 2.9 inches	54	13.5	10.3	12.2
Yellow:							
Homemade	April		2, 8-inch layers, 3.2 inches high	161	17.5	14.0	14.6
Mix (Type III):							
Brand A	March	18.0	2, 8-inch layers, 3.4 inches high	171	22.4	14.9	18.7
Brand B	October	19.0	2, 8-inch layers, 3.5 inches high	176	24.2	15.3	20.2
Bakery	April	19.0	2, 6.2-inch layers, 1.8 inches high	54	[5] 11.1	4.6	9.2

[1] Preparation date was 1 to 3 days after purchase, except for bakery form for which the month of purchase is given.
[2] Volume and weight of individual serving of homemade product was used as reference. (See table 6.)
[3] Weight was recorded in grams and converted to ounces.
[4] Proximate composition was determined on same sample. (See table 12.)
[5] Weight without frosting.

TABLE 8.—COOKIES: *Yield and number of servings of homemade, partly prepared, and ready-to-serve forms*

Name and form of product	Preparation month (1959)[1]	Purchase unit	Total yield			
			Measure	Baked weight	Servings[2]	
					By volume	By weight
		Ounces[3]		*Ounces*[3]	*Number*	*Number*
Brownies:						
Homemade	April		1 pan, 9 inches square, 0.8 inch thick	19. 9	27. 0	28. 4
Mix (Type I)	July	10. 5	1 pan, 6- x 8-inch rectangle, 1.0 inch thick.	13. 6	20. 0	19. 4
Mix (Type III):						
Brand A	April	16. 0	1 pan, 9 inches square, 0.6 inch thick	19. 3	20. 2	27. 6
Brand B	March	16. 0	1 pan, 8 inches square, 0.8 inch thick	19. 0	21. 3	27. 1
Frozen	April	14. 0	1 pan, 6.8- x 5.8-inch rectangle, 0.8 inch thick.	[4] 10. 9	13. 2	15. 6
Bakery:						
Brand A	do	7. 0	1 pan, 3.0- x 3.2-inch rectangle, 0.8 inch thick.	[4] 5. 9	3. 2	8. 4
Brand B[5]	August	7. 0	1 pan, 6.0- x 3.0-inch rectangle, 0.9 inch thick.	6. 0	7. 0	8. 6
Cookies (sugar):						
Homemade	June; September.		54 cookies, 2.0 x 0.2 inch	14. 5	27. 0	29. 0
Mix (Type I)	September	13. 5	48 cookies, 2.1 x 0.1 inch	14. 4	13. 3	28. 8
Mix (Type II)	June	11. 0	44 cookies, 2.3 x 0.2 inch	11. 8	28. 1	20. 0
Mix (Type III):						
Brand A	July	11. 0	34 cookies, 2.4 x 0.2 inch	11. 2	23. 7	22. 4
Brand B	August	40. 0 (8.9 used)	60 cookies, 2.2 x 0.4 inch	19. 8	70. 2	39. 6
Chilled in roll	June	11. 5	45 cookies, 2.1 x 0.2 inch	9. 7	28. 3	19. 4
Bakery:						
Brand A	do	13. 5	21 cookies, 2.9 x 0.4 inch	13. 5	42. 7	26. 8
Brand B[5]	September	14. 5	19 cookies, 3.1 x 0.3 inch	14. 5	33. 1	29. 0

[1] Preparation date was 1 to 3 days after purchase, except for bakery form for which the month of purchase is given.
[2] Volume and weight of individual serving of homemade product was used as reference. (See table 6.)
[3] Weight was recorded in grams and converted to ounces.
[4] Weight without frosting.
[5] Proximate composition was determined on same sample. (See table 12.)

TABLE 9.—PIES: *Yield and number of servings of homemade, partly prepared, and ready-to-serve forms*

Name and form of product	Preparation month (1959)[1]	Purchase unit	Total yield			
			Measure and proportion of crust and filling based on weight	Baked weight	Servings[2]	
					By volume	By weight
		Ounces[3]		*Ounces*[3]	*Number*	*Number*
Apple:						
Homemade	June		1, 8-inch pie Crust 38%, filling 62%	28. 2	6. 0	6. 0
Mix (Type I pastry, Type III filling):						
Brand A (cooked)[4]	August	Crust, 9.5; apples, 12.0.	1, 8-inch pie Crust 37%, filling 63%	28. 3	6. 0	6. 0
Brand AA						
Brand B	June	Crust, 10.0; filling, 20.0.	1, 8-inch pie Crust 35%, filling 65%	32. 3	6. 0	6. 9
Brand BB						
Brand C[4]	August	Crust, 10.0; filling, 20.0.	1, 8-inch pie Crust 40%, filling 60%	34. 9	6. 0	7. 4
Brand CC						

See footnotes at end of table.

TABLE 9.—PIES: *Yield and number of servings of homemade, partly prepared, and ready-to-serve forms*—Continued

Name and form of product	Preparation month (1959) [1]	Purchase unit	Total yield			
			Measure and proportion of crust and filling based on weight	Baked weight	Servings [2]	
					By volume	By weight
Apple—Continued						
Frozen:		*Ounces* [3]		*Ounces* [3]	*Number*	*Number*
Brand A	June	22.0	1, 8-inch pie Crust 46%, filling 54%	20.8	6.0	4.4
Brand B [4]	August	24.0	1, 8-inch pie Crust 40%, filling 60%	23.4	6.0	5.0
Bakery:						
Brand A	June	24.0	1, 8-inch pie Crust 88%, filling 12%	23.8	6.0	5.1
Brand B [4]	September	48.0	1, 10-inch pie Crust 42%, filling 58%	47.3	9.3	10.1
Cherry:						
Homemade	June		1, 8-inch pie Crust 45%, filling 55%	27.1	6.0	6.0
Mix (Type I pastry, canned filling):						
Brand A	do	Crust, 9.5; filling, 22.0.	1, 8-inch pie Crust 39%, filling 61%	29.2	6.0	6.5
Brand AA						
Brand B [4]	September	Crust, 10.0; filling, 22.0.	1, 8-inch pie Crust 36%, filling 64%	29.5	6.0	6.6
Brand BB						
Frozen:						
Brand A	June	25.0	1, 8-inch pie Crust 45%, filling 55%	22.9	6.0	5.1
Brand B [4]	September	24.0	1, 7-inch pie Crust 41%, filling 59%	22.6	4.6	5.0
Bakery:						
Brand A	June	24.0	1, 8-inch pie Crust 53%, filling 47%	23.5	6.0	5.2
Brand B [4]	September	40.0	1, 10-inch pie Crust 46%, filling 54%	40.0	9.3	8.9
Coconut:						
Homemade	June		1, 8-inch pie Crust 25%, filling 75%	30.4	6.0	6.0
Mix (Type I pastry, Type III filling):						
Brand A [4]	September	10.5	1, 8-inch pie Crust 15%, filling 85%	28.1	6.0	5.6
Brand B	June	Crust, 10.0 (5.0 used); filling, 2.2.	1, 8-inch pie Crust 28%, filling 72%	19.1	6.0	3.8
Brand BB						
Frozen:						
Brand A	do	24.0	1, 8-inch pie Crust 24%, filling 76%	22.5	6.0	4.5
Brand B [4]	September	26.0	1, 7-inch pie Crust 29%, filling 71%	22.5	4.6	4.5
Bakery:						
Brand A	June	18.0	1, 8-inch pie Crust 47%, filling 53%	[5] 12.4	6.0	2.5
Brand B [4]	September	38.0	1, 9-inch pie Crust 23%, filling 77%	37.3	7.6	7.5

[1] Preparation date was 1 to 3 days after purchase, except for bakery form for which the month of purchase is given.
[2] Volume and weight of individual serving of homemade product was used as reference. (See table 6.)
[3] Weight was recorded in grams and converted to ounces.
[4] Proximate composition was determined on same sample. (See table 12.)
[5] Weight without meringue.

TABLE 10.—BREADS: *Yield and number of servings of homemade, partly prepared, and ready-to-serve forms*

Name and form of product	Preparation month (1959)[1]	Purchase unit	Total yield		
			Measure	Baked weight	Servings[2]
					By volume
		Ounces[3]		*Ounces*[3]	*Number*
Baking powder biscuits:					
Homemade	June, August	---	19.0 biscuits	13.8	9.5
Mix (Type II):					
Brand A	June	40.0 (8.1 used)	15.5 biscuits	12.5	7.8
Brand B	August	40.0 (8.0 used)	16.0 biscuits	12.4	8.0
Refrigerated, chemically leavened.					
Brand A	June	8.0	10.0 biscuits	7.9	5.0
Brand B	August	8.0	10.0 biscuits	7.9	5.0
Refrigerated, partially yeast leavened.					
Frozen	June	7.9	10.0 biscuits	7.8	5.0
	August	13.7	12.0 biscuits	12.6	6.0
Corn muffins:					
Homemade	May, October	---	13.0 muffins	19.1	13.0
Mix (Type III):					
Brand A	October	14.0	14.8 muffins	21.6	14.8
Brand B	do	8.5	8.0 muffins	11.7	8.0
Pancakes:					
Homemade	June	---	9.3, 4.2-inch diameter	16.5	3.1
Mix (Type I)	(4)	14.0	22.0, 4.2-inch diameter	24.2	7.3
Mix (Type II):					
Brand A	July	16.0 (4.0 used)	9.3, 4.2-inch diameter	14.8	3.1
Brand B	June	40.0 (8.9 used)	11.7, 4.2-inch diameter	19.6	3.9
Mix (Type III):					
Brand A	do	16.0 (4.0 used)	8.7, 4.2-inch diameter	14.1	2.9
Brand B	August	16.0 (8.8 used)	17.3, 4.2-inch diameter	27.4	5.8
Frozen	June	9.1	6.0, 4.2-inch diameter	8.2	2.0
Waffles:					
Homemade	May	---	5.5, 7-inch waffles	18.2	5.5
Mix (Type I)	do	14.0	8.0, 7-inch waffles	29.2	8.0
Mix (Type III):					
Brand A	do	40.0 (7.8 used)	6.0, 7-inch waffles	24.3	6.0
Brand B	August	40.0 (8.9 used)	5.0, 7-inch waffles	22.3	5.0
Brand C	(4)	16.0 (8.9 used)	6.0, 7-inch waffles	25.2	6.0
Brand D	(4)	16.0 (4.4 used)	3.3, 7-inch waffles	13.5	3.3
Frozen:					
Brand A	May	5.6	6.0, 3.2- x 4-inch rectangle	5.0	2.0
Brand B	September	6.0	6.0, 3- x 3.5-inch rectangle	5.4	1.6
Yeast rolls:[5]					
Homemade	May, August	---	24.0 rolls	30.9	24.0
Mix (Type I):					
Brand A	May, August	14.2	15.0 rolls	14.8	15.0
Brand B	May, August	14.2	15.0 rolls	19.5	15.0

See footnotes at end of table.

TABLE 10.—BREADS: *Yield and number of servings of homemade, partly prepared, and ready-to-serve forms*—Continued

Name and form of product	Preparation month (1959)[1]	Purchase unit	Total yield			
			Measure	Baked weight	Servings[2]	
					By volume	By weight
Yeast rolls—Con.						
Frozen:[6]		*Ounces*[3]		*Ounces*[3]	*Number*	*Number*
Brand A	August	12.8	12.0 rolls	11.6	12.0	8.9
Brand B	do	19.9	18.0 rolls	19.4	18.0	14.9
Brown-and-serve:						
Brand A	May	12.5	12.0 rolls	12.2	12.0	9.4
Brand B[6]	August	8.8	6.0 rolls	8.5	6.0	6.5
Brand C	(4)	12.0	12.0 rolls	11.6	12.0	8.9
Bakery[6]	September	8.6	12.0 rolls	8.3	12.0	6.4

[1] Preparation date was 1 to 3 days after purchase, except for brown-and-serve and bakery forms for which the month of purchase is given.
[2] Volume and weight of individual serving of homemade product was used as reference. (See table 6.)
[3] Weight was recorded in grams and converted to ounces.
[4] February 1960.
[5] Proximate composition was determined on second replication.
[6] Proximate composition was determined on same sample. (See table 12.)

TABLE 11.—FROSTINGS: *Yield and number of servings of homemade and partly prepared forms*[1]

Name and form of product	Purchase unit	Total yield			
		Measure	Cooked weight	Servings[2]	
				By volume	By weight
Frosting (chocolate):	*Ounces*[3]	*Cups*	*Ounces*[3]	*Number*	*Number*
Homemade	-------	1.0	9.9	0.7	0.7
Mix (Type I):					
Brand A	5.5	.7	6.0	.5	.4
Brand B	15.0	1.5	16.4	1.0	1.1
Brand C	13.0	1.5	16.8	1.0	1.1
Frosting (white):					
Homemade	-------	4.0	13.3	1.5	1.5
Mix (Type I):					
Brand A	6.5	2.7	9.4	1.0	1.1
Brand B	6.5	2.7	8.8	1.0	1.0

[1] Preparation date was 1 to 3 days after purchase in May 1959.
[2] Amount needed to cover two 8- or 9-inch layers. Mix type was used as standard. (See table 6.)
[3] Weight was recorded in grams and converted to ounces.

Frozen, mix, or homemade two-crust pies, when baked, usually had from 35 to 45 percent crust on the basis of total weight of the pies (tables 9 and 12). Some bakery two-crust pies had from 53 to 88 percent crust. Coconut pie, a single crust type, usually had from 15 to 30 percent crust. One brand of bakery coconut pie, however, had as much as 47 percent crust.

Quality Characteristics

Compressibility readings of baked products prepared from mixes were often higher, an indication of greater softness of crumb, than readings on the homemade baked products (fig. 4). Manufacturers of mixes use low-protein flour fractions and emulsifiers in devil's food and yellow cake mixes and wheat starch in angel food cake mixes to insure softness in the baked cake crumb (*4*). However, yellow cakes made from either of two brands of mix and devil's food cake made from one brand of mix were less than half as compressible as the corresponding homemade cake. One brand of angel food mix and not the other, when baked, gave somewhat lower compressibility readings than the homemade form. Frozen and homemade devil's food cakes were equally compressible. Bakery cakes were usually more firm than any of the other forms of cakes tested.

Compressibility readings within a kind of cake —i.e., angel food, yellow—were highest for the forms that were highest in specific volume and often were lowest for cakes lowest in specific volume (figs. 3 and 4).

Pound cake, which is usually rather firm and compact in texture, had low compressibility readings (not shown). Homemade and frozen pound cakes were equally firm with readings of 2.0 mm. Pound cakes made from two brands of mixes differed, with readings of 4.2 and 1.6 mm., respectively. The bakery pound cakes were most firm, giving readings of 2.0 and 1.5 mm.

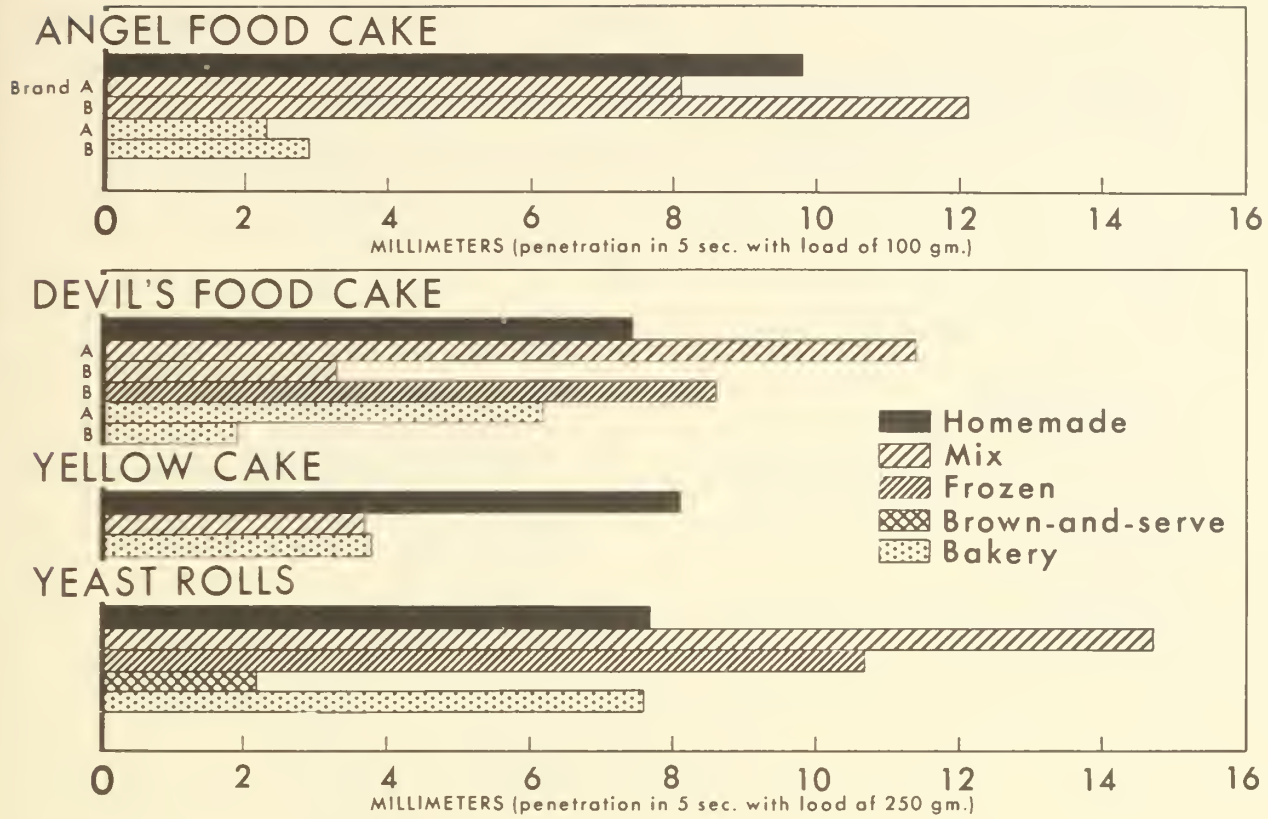

FIGURE 4.—Compressibility of four kinds of baked products.

Corn muffins, like pound cake, are not usually considered very compressible. The two brands of corn muffin mix, when baked, were equal in compressibility (readings 3.1 mm.) and were more compressible than the homemade corn muffins (reading 1.8 mm.).

Yeast rolls prepared from two brands of mix or baked from two brands of frozen rolls exceeded homemade yeast rolls in compressibility. Bakery rolls were equal in compressibility to, and the brown-and-serve rolls were about one-third as compressible as, homemade rolls.

Shear-force readings on Type II mix sugar cookies and on bakery cookies were approximately 50 and 100 percent higher (less tender) than readings on homemade sugar cookies (fig. 5). Low shear readings on sugar cookies made from dough chilled in a roll or from Type III mix indicated they were more tender than homemade cookies.

Homemade and frozen baking powder biscuits were about equal in tenderness and were most tender of the forms investigated. The other types of biscuits in order of increasing shear force (decreasing tenderness) were biscuits made from Type II mixes; biscuits made from partially yeast-leavened refrigerated dough; and biscuits made from chemically leavened refrigerated dough.

Pancakes and waffles made from mixes were somewhat more tender than the corresponding homemade products. The frozen form of pancakes or waffles was consistently less tender than any other form investigated.

Crusts of bakery pies were consistently less tender than crusts of the corresponding homemade or partly prepared pies (shear data not shown).

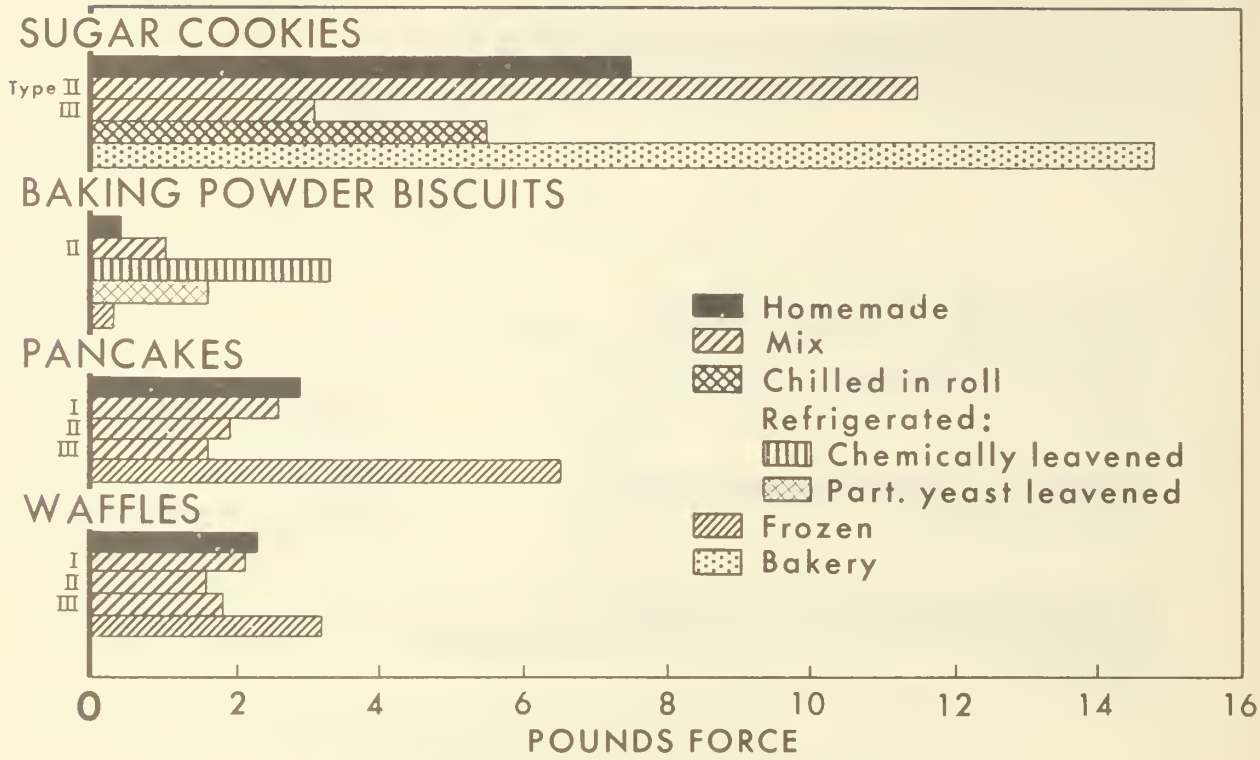

FIGURE 5.—Shear-force readings of four kinds of baked products.

Proximate Composition and Mineral Element Content

Comparisons of Composition of the Different Foods Studied

The ready-to-serve foods in this study were of high caloric value (table 12), and within each food group, caloric values usually followed fat content. For all food items, except pie fillings, energy values per 100-gram portion were 200 Calories or more, reaching a maximum of 600 Calories per 100 grams of baked unfilled pie shell. Energy values for cakes and cookies were higher per 100 grams than those for pies, with unbuttered breads intermediate in value.

Individual serving sizes ranged in weight from around 15 grams for a serving of sugar cookies to more than 140 grams for a serving of coconut pie. For this reason, ranking of foods by caloric content per serving differed from ranking by energy value of 100-gram portions. For individual servings, caloric values were highest in pies and pancakes and lowest in sugar cookies and yeast rolls.

TABLE 12.—*Proximate composition of ready-to-serve baked products prepared from different market forms*

Item number	Description of sample and date received	100-gram portion						Individual serving by volume [1]						
		Moisture	Food energy	Fat	Protein	Ash	Carbohydrate (by difference)	Weight	Moisture	Food energy	Fat	Protein	Ash	Carbohydrate (by difference)
	CAKES [2]													
	ANGEL FOOD CAKE:	*Grams*	*Calories*	*Grams*	*Grams*	*Grams*	*Grams*	*Grams*	*Grams*	*Calories*	*Grams*	*Grams*	*Grams*	*Grams*
1	Homemade (9/60)	30.8	272	0.2	6.1	0.7	62.2	49	15.1	133	0.1	3.0	0.3	30.5
2	Mix: Type I, Brand A (9/60)	34.0	259	.2	5.7	.7	59.4	40	13.6	104	.1	2.3	.3	23.7
	Bakery:													
3	Brand A (9/59)	29.9	271	.0	6.0	1.7	62.4	62	18.5	168	.0	3.7	1.1	38.7
4	Brand B (9/59)	30.7	269	.0	6.4	1.4	61.5	88	27.0	237	.0	5.6	1.2	54.2
	DEVIL'S FOOD CAKE:													
5	Homemade (3/60)	25.6	355	15.6	5.1	1.2	52.5	49	12.5	174	7.6	2.5	.6	25.8
	Mix:													
6	Type III, Brand A (3/60)	32.6	267	4.3	4.2	1.6	57.3	43	14.0	115	1.8	1.8	.7	24.7
7	Type III, Brand B (8/59) [3]	27.4	325	11.7	4.8	1.6	54.5	81	22.2	263	9.5	3.9	1.3	44.1
	Frozen:													
8	Brand A (9/59)	29.5	328	13.7	5.0	1.6	50.2	49	14.5	161	6.7	2.5	.8	24.5
9	Brand B (8/59) [3]	24.7	368	18.0	5.2	1.8	50.3	70	17.3	258	12.6	3.6	1.3	35.2
	Bakery:													
10	Brand A (8/59)	21.6	341	9.9	4.7	1.7	62.1	55	11.9	188	5.4	2.6	.9	34.2
11	Brand C (9/59)	27.3	324	11.8	5.0	1.9	54.0							
	POUND CAKE:													
12	Homemade (9/60)	21.3	419	22.2	6.5	.8	49.2	31	6.6	130	6.9	2.0	.2	15.3
13	Mix: Type III, Brand B (9/60)	25.8	368	15.7	5.0	1.3	52.2	34	8.8	125	5.3	1.7	.4	17.8
14	Frozen (8/59)	21.4	418	22.5	4.9	1.3	49.9	33	7.1	138	7.4	1.6	.4	16.5
	Bakery:													
15	Brand A (9/59)	20.1	413	20.1	4.5	1.0	54.3	29	5.8	120	5.8	1.3	.3	15.8
16	Brand B (8/59) [3]	22.4	376	14.6	4.9	1.4	56.7	37	8.3	139	5.4	1.8	.5	21.0
	YELLOW CAKE:													
17	Homemade (9/60)	18.7	376	12.0	6.3	1.8	61.2	35	6.5	132	4.2	2.2	.6	21.5
18	Mix: Type III, Brand A (9/60)	30.5	317	9.8	4.6	1.5	53.6	43	13.1	136	4.2	2.0	.6	23.1
19	Bakery (9/59)	25.6	360	14.7	4.5	2.0	53.2	68	17.4	245	10.0	3.1	1.4	36.1
	COOKIES													
	BROWNIES: [2] [4]													
20	Homemade (9/60)	9.8	497	33.4	6.6	1.3	48.9	21	2.1	104	7.0	1.4	.3	10.2
	Mix:													
21	Type I (9/60)	15.3	403	18.7	4.8	1.3	59.9	19	2.9	77	3.6	.9	.2	11.4
22	Type III, Brand B (9/60)	10.7	426	20.1	5.0	1.1	63.1	25	2.7	106	5.0	1.2	.3	15.8
23	Frozen (9/59)	13.1	422	21.5	5.7	1.3	58.4	23	3.0	97	4.9	1.3	.3	13.5
24	Bakery (8/59) [5]	12.5	432	22.1	5.8	1.2	58.4	24	3.0	104	5.3	1.4	.3	14.0

See footnotes at end of table.

TABLE 12.—*Proximate composition of ready-to-serve baked products prepared from different market forms*—Continued

Item number	Description of sample and date received	100-gram portion						Individual serving by volume [1]						
		Moisture	Food energy	Fat	Protein	Ash	Carbohydrate (by difference)	Weight	Moisture	Food energy	Fat	Protein	Ash	Carbohydrate (by difference)
	COOKIES—Continued													
	SUGAR COOKIES:	*Grams*	*Calories*	*Grams*	*Grams*	*Grams*	*Grams*	*Grams*	*Grams*	*Calories*	*Grams*	*Grams*	*Grams*	*Grams*
25	Homemade (9/60)	4.1	470	19.4	5.9	1.6	69.0	15	0.6	70	2.9	0.9	0.2	10.4
	Mix, Brand C:													
26	Type I (9/60)	3.0	492	22.8	3.9	1.0	69.3	31	.9	153	7.1	1.2	.3	21.5
27	Type III (1/61)	4.3	483	21.5	6.0	.8	67.4	8	.3	39	1.7	.5	.1	5.4
28	Chilled in roll (9/60)	3.4	503	25.6	4.7	1.9	64.4	10	.3	50	2.6	.5	.2	6.4
	Bakery:													
29	Brand A (9/59)	5.4	464	18.3	4.8	.7	70.8	9	.5	42	1.6	.4	.1	6.4
30	Brand B (9/59) [5]	5.4	441	13.7	4.3	1.1	75.5	12	.6	53	1.6	.5	.1	9.2
	PIES													
	APPLE:													
31	Homemade (9/60):													
	Crust	28.0	379	18.5	4.8	1.1	47.6	51	14.3	193	9.4	2.4	.6	24.3
	Filling	65.1	136	1.1	.5	.3	33.0	83	54.0	113	.9	.4	.2	27.5
	Crust, 38%, and filling, 62%	51.0	229	7.7	2.2	.6	38.5	134	68.3	306	10.3	2.8	.8	51.8
	Mix:													
32	Crust, Type I, Brand A (8/59) [6]	23.6	411	21.7	5.0	1.3	48.4	50	11.8	206	10.8	2.5	.6	24.3
	Filling, dried apples, Brand AA	60.9	147	.1	.4	.7	37.9	82	49.9	121	.1	.3	.6	31.1
	Crust, 38%, and filling, 62%	46.7	248	8.3	2.1	.9	42.0	132	61.7	327	10.9	2.8	1.2	55.4
33	Crust, Type I, Brand C (8/59) [6]	25.2	395	19.4	4.9	1.1	49.4	66	16.6	261	12.8	3.2	.7	32.7
	Filling, canned, Brand CC	68.6	117	.0	.3	.2	30.9	98	67.2	115	.0	.3	.2	30.3
	Crust, 40%, and filling, 60%	51.2	228	7.8	2.1	.6	38.3	164	83.8	376	12.8	3.5	.9	63.0
34	Frozen, Brand B (8/59): [6]													
	Crust	26.0	408	23.1	3.9	1.0	46.0	43	11.2	175	9.9	1.7	.4	19.8
	Filling	70.7	110	.1	.2	.4	28.6	65	46.0	72	.1	.1	.3	18.5
	Crust, 40%, and filling, 60%	52.8	229	9.3	1.7	.6	35.6	108	57.2	247	10.0	1.8	.7	38.3
	Bakery:													
35	Brand A (8/59):													
	Crust	23.8	414	22.9	3.9	1.4	48.0	56	13.3	232	12.8	2.2	.8	26.9
	Filling	53.4	175	.1	.2	1.0	45.3	58	31.0	102	.1	.1	.6	26.2
	Crust, 49%, and filling, 51%	38.9	292	11.3	2.0	1.2	46.6	114	44.3	334	12.9	2.3	1.4	53.1
36	Brand B (9/59): [6]													
	Crust	27.6	404	23.3	4.4	.9	43.8	60	16.6	242	14.0	2.6	.5	26.3
	Filling	65.9	128	.1	.2	.5	33.3	84	55.4	108	.1	.2	.4	27.9
	Crust, 42%, and filling, 58%	49.8	244	9.8	2.0	.7	37.7	144	72.0	350	14.1	2.8	.9	54.2

	CHERRY:												
37	Homemade (9/59):												
	Crust	21.6	443	26.6	4.9	1.3	45.6	58	12.5	257	15.4	2.8	.8	26.5
	Filling	66.3	134	1.8	1.1	.5	30.3	71	47.1	95	1.3	.8	.4	21.4
	Crust, 45%, and filling, 55%	46.2	273	13.0	2.8	.9	37.1	129	59.6	352	16.7	3.6	1.2	47.9
	Mix:													
38	Crust, Type I, Brand B (9/59) [6]	22.9	416	22.1	4.3	1.4	49.3	51	11.7	212	11.3	2.2	.7	25.1
	Filling, canned, Brand BB	63.3	139	.0	.9	.5	35.3	87	55.1	121	.0	.8	.4	30.7
	Crust, 37%, and filling, 63%	48.4	241	8.2	2.2	.8	40.4	138	66.8	333	11.3	3.0	1.1	55.8
39	Frozen, Brand B (9/59): [6]													
	Crust	19.1	447	26.0	3.5	1.3	50.1	58	11.1	259	15.1	2.0	.8	29.0
	Filling	58.4	159	.2	.7	.6	40.1	80	16.7	127	.2	.6	.5	32.0
	Crust, 42%, and filling, 58%	41.9	280	11.0	1.9	.9	44.3	138	57.8	386	15.3	2.6	1.3	61.0
40	Bakery, Brand B (9/59): [6]													
	Crust	26.8	402	22.2	4.6	.9	45.5	56	15.0	225	12.4	2.6	.5	25.5
	Filling	60.1	152	.1	.6	.5	38.7	68	40.9	103	.1	.4	.3	26.3
	Crust, 45%, and filling, 55%	45.1	264	10.0	2.4	.7	41.8	124	55.9	328	12.5	3.0	.8	51.8
	COCONUT:													
41	Homemade (9/60):													
	Crust	29.7	374	19.3	6.3	1.4	43.3	36	10.7	135	6.9	2.3	.5	15.6
	Filling	71.2	146	7.3	5.6	1.0	14.9	108	76.9	158	7.9	6.0	1.1	16.1
	Crust, 25%, and filling, 75%	60.8	203	10.3	5.8	1.1	22.0	144	87.6	293	14.8	8.3	1.6	31.7
	Mix:													
42	Brand A, I (9/59): [6]													
	Crust, Type I	16.6	454	25.0	5.4	1.8	51.2	19	3.2	86	4.8	1.0	.3	9.7
	Filling, Type III	65.4	155	4.6	4.1	1.0	24.9	110	71.9	170	5.1	4.5	1.1	27.4
	Crust, 15%, and filling, 85%	58.1	200	7.7	4.3	1.1	28.8	129	75.1	256	9.9	5.5	1.4	37.1
43	Brand A, II (4/61):													
	Crust, Type I	13.4	477	27.4	5.9	2.1	51.2	26	3.5	124	7.1	1.5	.5	13.4
	Filling, Type III	67.7	151	5.4	4.5	.9	21.5	120	81.2	181	6.5	5.4	1.1	25.8
	Crust, 18%, and filling, 82%	57.9	210	9.4	4.8	1.1	26.8	146	84.7	305	13.6	6.9	1.6	39.2
44	Frozen, Brand B (9/59): [6]													
	Crust	26.8	389	19.7	5.6	1.2	46.7	40	10.7	156	7.9	2.2	.5	18.7
	Filling	62.1	186	8.6	6.1	1.4	21.8	94	58.4	175	8.1	5.7	1.3	20.5
	Crust, 30%, and filling, 70%	51.5	247	11.9	6.0	1.3	29.3	134	69.1	331	16.0	7.9	1.8	39.2
	Bakery:													
45	Brand B, I (9/59): [6]													
	Crust	28.3	385	20.3	5.4	1.3	44.7	32	9.1	123	6.5	1.7	.4	14.3
	Filling	58.1	168	1.4	5.5	1.1	33.9	108	62.7	181	1.5	5.9	1.2	36.7
	Crust, 23%, and filling, 77%	51.2	218	5.7	5.5	1.1	36.5	140	71.8	304	8.0	7.6	1.6	51.0
46	Brand B, II (3/61):													
	Crust	30.2	371	18.9	6.3	1.2	43.4	34	10.3	126	6.4	2.1	.4	14.8
	Filling	62.0	155	1.8	5.3	.9	30.0	112	69.4	174	2.0	5.9	1.0	33.7
	Crust, 23%, and filling, 77%	54.7	205	5.7	5.5	1.0	33.1	146	79.7	300	8.4	8.0	1.4	48.5
	PIE CRUST:													
47	Homemade, baked shell (11/60)	.7	600	41.8	7.0	1.3	49.2	36	.3	216	15.0	2.5	.5	17.7

See footnotes at end of table.

TABLE 12.—*Proximate composition of ready-to-serve baked products prepared from different market forms*—Continued

Item number	Description of sample and date received	100-gram portion						Individual serving by volume [1]						
		Moisture	Food energy	Fat	Protein	Ash	Carbohydrate (by difference)	Weight	Moisture	Food energy	Fat	Protein	Ash	Carbohydrate (by difference)
	BREADS													
	BAKING POWDER BISCUITS:	*Grams*	*Calories*	*Grams*	*Grams*	*Grams*	*Grams*	*Grams*	*Grams*	*Calories*	*Grams*	*Grams*	*Grams*	*Grams*
48	Homemade (8/60)	24.2	384	17.0	7.5	1.8	49.5	41	9.9	157	7.0	3.1	0.7	20.3
49	Mix, Type II, Brand A (9/60)	28.5	323	9.6	7.4	2.8	51.7	44	12.5	142	4.2	3.3	1.2	22.8
50	Refrigerated, chemically leavened, Brand C (9/60).	30.2	294	4.8	8.2	3.5	53.3	42	12.7	123	2.0	3.4	1.5	22.4
51	Frozen (9/60)	24.2	358	13.0	7.1	3.0	52.7	60	14.5	215	7.8	4.3	1.8	31.6
	CORN MUFFINS:													
52	Homemade (9/60)	32.7	315	10.1	7.1	2.0	48.1	42	13.7	132	4.2	3.0	.8	20.3
53	Mix, Brand C (9/60)	30.4	324	10.6	6.9	2.1	50.0	39	11.9	126	4.1	2.7	.8	19.5
54	Bakery (9/59)	27.8	327	9.4	5.8	2.3	54.7	38	10.6	124	3.6	2.2	.9	20.7
	PANCAKES:													
55	Homemade (9/60)	45.0	253	7.4	7.8	1.8	38.0	151	68.0	382	11.2	11.8	2.7	57.3
	Mix, Brand A:													
56	Type II (9/60)	53.9	204	5.6	6.3	2.5	31.7	135	72.8	275	7.6	8.5	3.4	42.7
57	Type III (9/60)	50.6	226	7.3	7.5	2.5	32.1	138	69.8	312	10.1	10.4	3.4	44.3
58	Frozen (9/60)	38.1	261	5.8	5.7	4.2	46.2	117	44.6	305	6.8	6.7	4.9	54.0
	WAFFLES:													
59	Homemade (9/60)	41.4	279	9.8	9.3	2.0	37.5	94	38.9	262	9.2	8.7	1.9	35.3
	Mix:													
60	Type I (9/60)	38.6	305	14.0	4.8	2.4	40.2	104	40.1	317	14.6	5.0	2.5	41.8
61	Type III, Brand A (9/60)	41.7	277	10.6	8.8	2.7	36.2	119	49.6	330	12.6	10.5	3.2	43.1
62	Frozen (9/60)	37.9	274	7.2	6.9	2.8	45.2	71	26.9	195	5.1	4.9	2.0	32.1
	YEAST ROLLS:													
63	Homemade (8/59) [7]	26.1	334	8.7	8.2	.9	56.1	36	9.4	120	3.1	3.0	.3	20.2
	Mix: [7]													
64	Brand A (8/59)	30.6	299	4.5	9.0	1.4	54.5	28	8.6	84	1.3	2.5	.4	15.2
65	Brand B (8/59)	30.2	311	6.9	8.5	1.3	53.1	37	11.2	115	2.6	3.1	.5	19.6
	Frozen: [7]													
66	Brand A (8/59)	25.1	329	6.4	9.5	1.8	57.2	27	6.8	89	1.7	2.6	.5	15.4
67	Brand B (8/59)	28.3	311	5.4	8.5	1.8	56.0	31	8.8	96	1.7	2.6	.6	17.3
68	Brown-and-serve, Brand B (8/59) [7]	26.9	328	7.8	8.8	1.8	54.7	30	8.1	98	2.3	2.6	.5	16.5
	Bakery:													
69	Butter-type, I (8/59)	25.6	329	6.9	9.8	1.7	56.0	19	4.9	63	1.3	1.9	.3	10.6
70	Butter-type, II (9/59) [7]	25.7	329	6.9	9.8	1.8	55.8	20	5.1	66	1.4	2.0	.4	11.1
71	Hamburger-type, Brand A (8/59)	32.6	285	4.0	8.4	2.1	52.9							
72	Hamburger-type, Brand B (8/59)	32.6	296	5.9	8.3	1.8	51.4							

[1] Volume of individual serving of homemade product was used as reference. (See table 6.)
[2] Without frosting or filling.
[3] Yields were determined on the same sample. (See table 7.)
[4] Contain nuts.
[5] Yields were determined on the same sample. (See table 8.)
[6] Yields were determined on the same sample. (See table 9.)
[7] Yields were determined on the same sample. (See table 10.)

Fat content ranged from almost none in angel food cakes to more than 20 percent in cookies and 40 percent in unfilled baked pie shell. Except for pie fillings, about half of the composition by weight of the food, as served, was carbohydrate. Protein values were less than 10 percent by weight for all foods analyzed.

Comparison of Composition of Different Market Forms

In order to compare the different commercial forms, each nutrient value for every commercial form was calculated as the percentage of the corresponding value for the homemade form, which was assigned a reference value of 100 percent. These percentages were then summarized both by food group—cake, pie, etc.—and by commercial form—mix, frozen (figs. 6 and 7).

Moisture content was usually higher and ash markedly higher, in the commercial forms than in the corresponding homemade forms of the various products studied (fig. 6). Protein and fat content were nearly always lower in commercial than in homemade foods. Carbohydrate content, for most forms and products studied, was about the same in commercial as in homemade items. Some exceptions to the general trends were noted (table 12). For example, variations in fat content and caloric values for devil's food or pound cakes were as great between brands of the same market form as among the different forms studied. Within a food group, individual components frequently showed interesting variations. Thus, fat in baking powder biscuits increased in almost stepwise fashion, from commercial refrigerated dough through mix and frozen to the homemade form. Cakes and brownies made from mixes were higher in moisture than were other commercial forms. These mixes contained emulsifiers, emulsified shortening, or wheat starch, ingredients which probably contributed to the greater moisture-retaining capacity of the mixes. Except for refrigerated dough and brown-and-serve products,

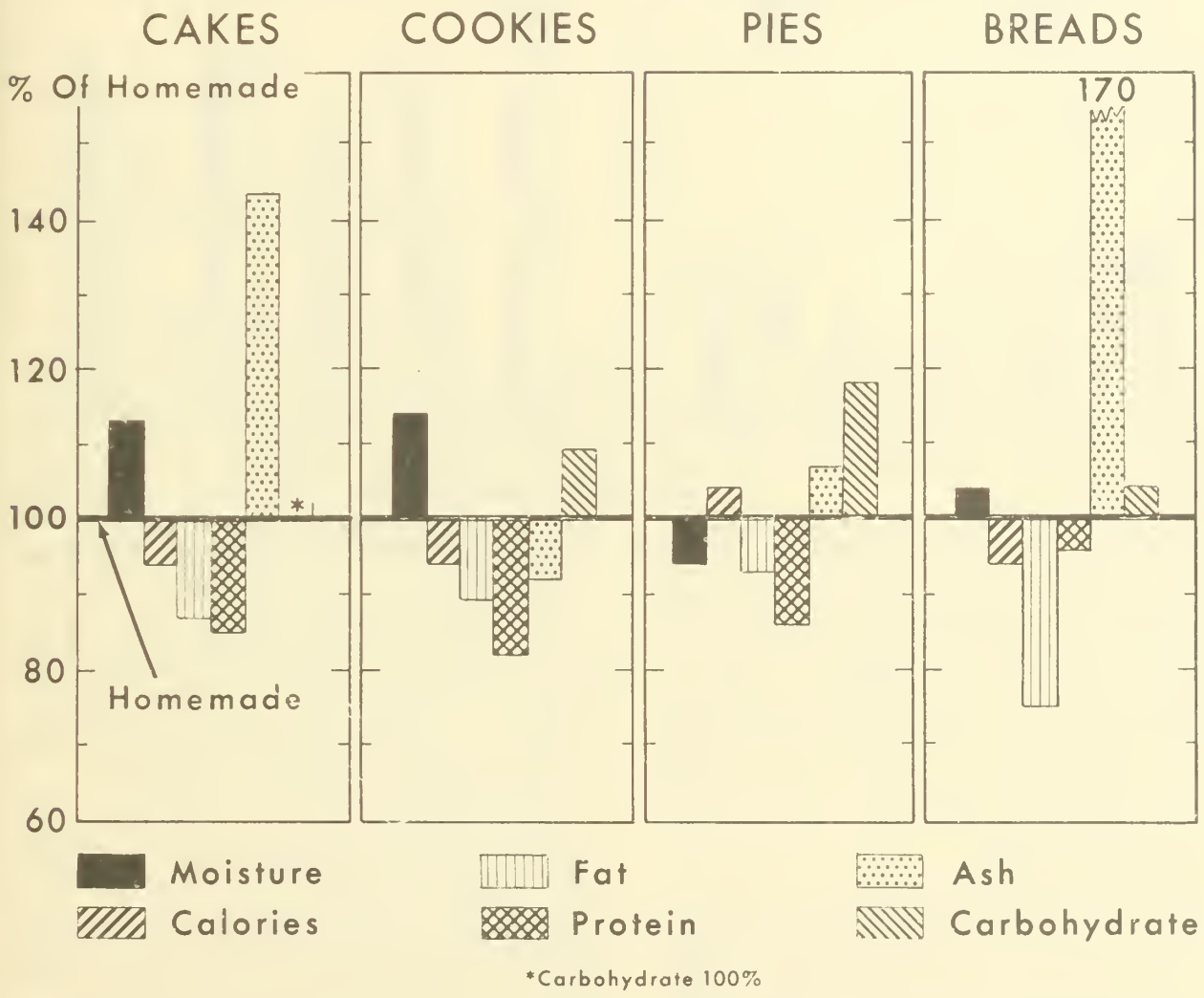

FIGURE 6.—Proximate composition and caloric values of different baked products—all commercial forms combined and expressed as percentages of homemade forms.

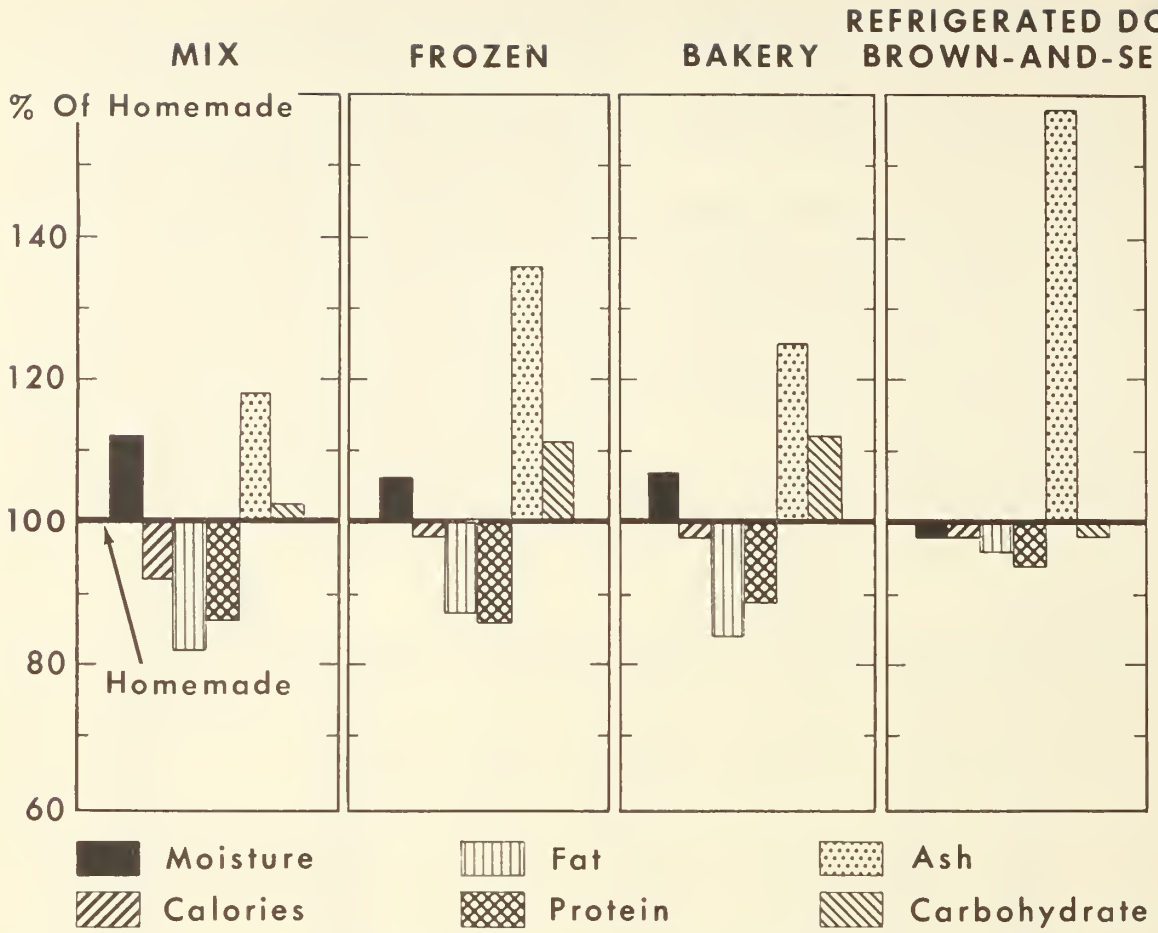

FIGURE 7.—Proximate composition and caloric values of different market forms of baked products, expressed as percentages of values for homemade products.

the various commercial forms were similar to each other in patterns of relationships to homemade foods (fig. 7).

Homemade brownies, which were made with chocolate, contained more fat and less moisture than commercial forms of brownies, which were made with cocoa. The high fat content of the homemade form was due in part to the high proportion of added pecans (table 2) as well as the use of chocolate in the formulation. The calculated fat content of the homemade brownies, excluding fat contributed by nuts and chocolate, would be approximately 19 percent. This level is in good agreement with fat in commercial forms that included nuts and cocoa. The homemade form apparently contained more shortening than did commercial forms.

According to Lowe (*9*), volume of cake increases with addition of baking powder and sugar to optimum levels, and decreases with addition of fat and of egg. Volume may, therefore, be related directly to ash or inversely to fat content. However, no discernible relationships between specific volume (fig. 3) and fat, protein, or moisture content could be observed. Ash values, contrary to prediction, tended to be highest in cakes having the lowest specific volumes. Variations among brands and commercial forms in the kinds of fat and leavening agents used could conceivably cause these deviations from expected relationships.

Composition of Dry Mixes and Finished Products Made From Mixes

Proximate composition data for 62 dry mixes representing all the food groups in the study, along with date of purchase, ingredient contents as given on labels, and ingredients to be added, are given in table 13. In addition, proximate composition data for 19 finished products corresponding to 16 of the mix items are included in table 12.

Listed ingredients used in angel food mixes were fairly constant, both among brands and over a period of time for the same brand. The proportion of flour mix to egg-white mix was also relatively uniform. Moisture, caloric, fat, and carbohydrate content varied little among the samples analyzed. Protein and ash levels of both flour and egg-white portions of the mixes varied most.

Two samples of one brand of devil's food mix, obtained and analyzed 6 months apart, had nearly identical proximate values. Fat content,

however, was less than half that of the other two brands of devil's food mix analyzed. The baked cake made from this brand of mix (item 6, table 12) was correspondingly low in fat.

Nine yellow and five white cake mixes, representing five manufacturers' brands, were analyzed. Listed ingredients in the white cakes differed from those in yellow mixes only in the absence of coloring. With few exceptions, composition values varied little between yellow and white cake of the same brand, among brands, or over a period of time for the same brand (table 13). While these data are from a limited number of samples, good agreement in most composition values suggests that wider sampling at that time would not have appreciably altered conclusions reported here.

The fat and protein contents of the yellow and white cake mixes are compared graphically by year and brand (fig. 8). Few differences can be seen among any of the possible comparisons. Brand D yellow cake for 1960 was lowest in fat of all yellow or white cake mixes. Brand A devil's food and brand C pound cake mixes, made by the same manufacturer, also contained far less fat than corresponding mix types of other brands.

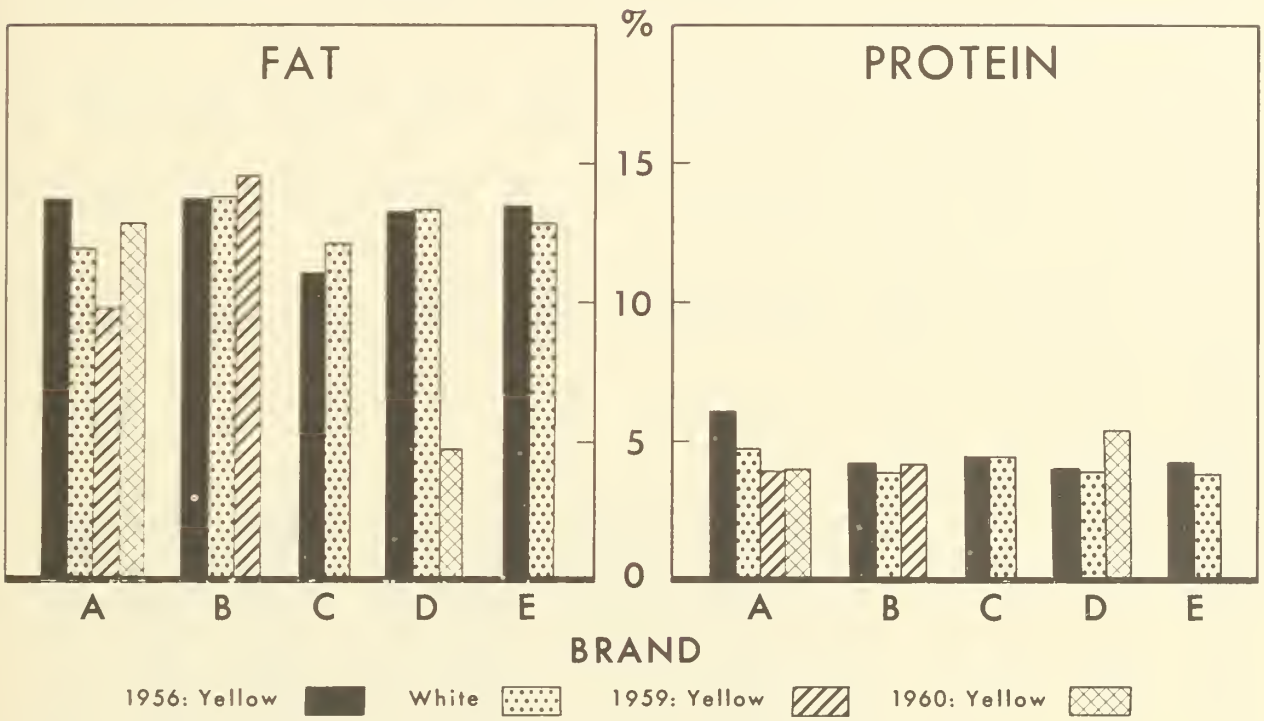

FIGURE 8.—Percentages of fat and protein in different brands of yellow and white cake mixes obtained in different years.

TABLE 13.—*Proximate composition and labeled ingredients of market-purchased dry mixes*

Description of sample and date received	Ingredients [1]	Composition per 100 grams mix						Ingredients to be added	Matching prepared product (table 12)
		Moisture	Food energy	Fat	Protein	Ash	Carbohydrate (by difference)		
CAKES									
ANGEL FOOD:		*Grams*	*Calories*	*Grams*	*Grams*	*Grams*	*Grams*		*Item No.*
Type I:									
Brand A (7/56)	Sugar, cake flour, dried egg whites, wheat starch, leavening, salt, flavoring.							Water	
	Flour mix	2.5	382	0.2	1.5	0.5	95.3		
	Egg mix	2.9	379	.1	23.8	2.4	70.8		
	Flour mix, 71%, and egg mix, 29%	2.6	382	.2	8.0	1.1	88.2		
Do. (9/59)	Same as above, except no wheat starch							Water	
	Flour mix	2.0	384	.1	2.2	.5	95.2		
	Egg mix	1.7	384	.1	25.1	2.4	70.7		
	Flour mix, 71%, and egg mix, 29%	1.9	384	.1	8.8	1.1	88.1		
Do. (9/60)	Sugar, flour, dried egg whites with whipping aid, wheat starch, phosphate, salt, cream of tartar, triacitin, flavoring.							Water	2
	Flour mix	2.6	382	.2	2.1	.6	94.5		
	Egg mix	1.9	384	.1	27.6	2.5	67.9		
	Flour mix, 72%, and egg mix, 28%	2.4	383	.2	9.2	1.1	87.1		
Brand B (7/56)	Sugar, cake flour, dried egg whites, wheat starch, leavening, salt, flavoring.							Water	
	Flour mix	1.7	382	.2	1.8	1.4	94.9		
	Egg mix	3.4	374	.1	26.1	3.4	67.0		
	Flour mix, 76%, and egg mix, 24%	2.1	380	.2	7.6	1.9	88.2		
Do. (9/59)	Sugar, cake flour, dried egg whites, leavening, salt, flavoring.							Water	
	Flour mix	2.0	382	.2	2.3	1.1	94.4		
	Egg mix	1.4	388	.1	21.5	1.1	75.9		
	Flour mix, 71%, and egg mix, 29%	1.8	385	.2	8.0	1.1	88.9		
Brand C (7/56)	Sugar, cake flour, dried egg whites, leavening, salt, flavoring, emulsifier.							Water	
	Flour mix	2.1	383	.2	1.6	.6	95.5		
	Egg mix	3.3	377	.1	26.2	2.7	67.7		
	Flour mix, 75%, and egg mix, 25%	2.4	382	.2	7.8	1.1	88.5		
Brand D (7/56)	Sugar, cake flour, egg whites, wheat starch, leavening, salt, flavoring.							Water	
	Flour mix	1.8	383	.2	1.7	1.1	95.2		
	Egg mix	2.6	379	.1	24.4	2.6	70.3		
	Flour mix, 72%, and egg mix, 28%	2.0	382	.2	8.1	1.5	88.2		

DEVIL'S FOOD:									
Type III:									
Brand A (9/59)	Sugar, cake flour, cocoa, dextrose, shortening, emulsifiers, baking powder, nonfat dry milk, salt, flavoring.	3.1	378	5.4	4.7	2.1	84.7	Eggs, water	
Do. (3/60)	do	3.1	378	5.5	4.4	2.3	84.7	do	6
Brand B (5/61)	Sugar, cake flour, shortening with freshness preserver, cocoa (alkali processed), nonfat dry milk, emulsifier, leavening, salt, artificial flavoring, cellulose gum.	3.1	410	11.5	5.0	2.2	78.2	do	
Brand C (5/61)	Flour, shortening, preserver, Holland cocoa (alkali processed), leavening, salt, defatted milk solids, vegetable hydrocolloids, sodium phosphate, sodium carboxymethylcellulose, GLP emulsifier.	2.4	423	13.9	4.9	2.7	76.1	do	
POUND:									
Type III:									
Brand B (9/60)	Sugar, cake flour, shortening, wheat starch, salt, nonfat dry milk, baking powder, flavoring, coloring.	3.6	468	18.4	3.5	1.4	73.1	Eggs, milk	13
Brand C (8/59)	Sugar, cake flour, dextrose, shortening, emulsifiers, salt, baking powder, flavoring, preservative, coloring.	2.9	412	6.2	3.4	1.1	86.4	Eggs, water	
YELLOW:									
Type II:									
Brand A (7/56)	Cake flour, sugar, emulsified shortening, eggs, baking powder, nonfat milk solids, salt, flavor and color, oil of lemon.	2.9	443	13.7	6.0	2.2	75.2	Milk	
Type III:									
Brand A (9/59)	Sugar, cake flour, emulsified shortening, nonfat dry milk, baking powder, salt, coloring, flavoring.	2.6	424	9.7	3.9	2.0	81.8	Eggs, water	
Brand A (9/60)	Sugar, flour, emulsified shortening with freshness preserver, nonfat dry milk, leavening, salt, coloring, flavoring.	3.5	436	12.8	4.0	2.0	77.7	do	18
Brand B (7/56)	Sugar, cake flour, shortening, nonfat dry milk solids, leavening, salt, flavoring, coloring.	2.2	446	13.7	4.2	2.0	77.9	do	
Do. (9/59)	do	3.5	446	14.5	4.1	1.8	76.1	do	
Brand C (7/56) [2]	do	3.6	427	11.0	4.4	2.2	78.8	do	
Brand D (7/56)	Sugar, cake flour, shortening, nonfat dry milk solids, baking powder, emulsifiers, salt, flavoring, coloring.	1.7	445	13.2	4.0	2.2	78.9	do	
Do. (12/60)	Same as above, plus dextrose	3.9	394	4.7	5.3	2.3	83.8	do	
Brand E (7/56)	Sugar, cake flour, shortening, nonfat dry milk solids, baking powder, salt, coloring, flavoring, emulsifier.	4.0	437	13.4	4.2	2.2	76.2	do	
WHITE:									
Type II:									
Brand A (7/56)	Sugar, cake flour, emulsified shortening, baking powder, egg white, salt, flavoring.	2.8	436	11.9	4.7	1.7	78.9	Milk	

See footnotes at end of table.

TABLE 13.—*Proximate composition and labeled ingredients of market-purchased dry mixes*—Continued

Description of sample and date received	Ingredients [1]	Composition per 100 grams mix						Ingredients to be added	Matching prepared product (table 12)
		Moisture	Food energy	Fat	Protein	Ash	Carbohydrate (by difference)		
CAKES—Continued									
WHITE—Continued		*Grams*	*Calories*	*Grams*	*Grams*	*Grams*	*Grams*		*Item No.*
Type III:									
Brand B (7/56)	Sugar, cake flour, shortening, nonfat dry milk solids, leavening, salt, flavoring.	2.2	447	13.8	3.8	1.9	78.3	Egg whites, water.	
Brand C (7/56) [2]	do	4.0	430	12.1	4.4	2.3	77.2	do	
Brand D (7/56)	Sugar, cake flour, shortening, nonfat dry milk solids, baking powder, salt, emulsifier, flavoring.	2.5	444	13.3	3.9	1.8	78.5	do	
Brand E (7/56)	Sugar, cake flour, shortening, nonfat dry milk solids, emulsifier, baking powder, salt, flavoring.	3.8	435	12.8	3.8	2.2	77.4	do	
COOKIES									
BROWNIES:									
Type I (9/59)	Sugar, flour, shortening, cocoa, salt, dry egg solids, flavoring, leavening.	3.0	418	12.0	4.8	1.5	78.7	Water, nuts	
Do. (9/60)	do	3.4	430	14.6	5.0	1.5	75.5	do	21
Type III:									
Brand A (9/59)	Sugar, flour, shortening, cocoa, salt, leavening, flavoring.	2.2	442	17.0	4.2	1.0	75.6	Egg, water, nuts.	
Brand B (8/59)	Sugar, flour, emulsified shortening, cocoa, soda, salt, flavoring.	2.4	433	15.2	3.6	1.1	77.7	do	
Do. (9/60)	Sugar, flour, shortening with freshness preserver, cocoa, salt, soda, flavoring.	2.0	436	15.5	3.8	1.2	77.5	do	22
SUGAR:									
Type I or II:									
Brand A (8/59)	Flour, sugar, shortening, baking powder, salt.	4.2	493	24.2	3.5	1.3	66.8	Water *or* milk, *or* fruit juice; flavoring.	
Type I or III:									
Brand C (9/60)	Sugar, flour, shortening, soy flour, salt, soda, flavoring.	4.3	489	23.1	3.7	.8	68.1	Water *or* egg, water.	26, 27
PIE									
CRUST:									
Type I:									
Brand A (7/56)	Flour, shortening, salt	6.4	532	33.0	7.1	2.2	51.3	Water *or* milk.	
Do. (12/60)	Flour, shortening with freshness preserver, salt, coloring.	7.5	524	32.2	8.0	2.1	50.2	Cold water	
Brand B (12/60)	do	5.1	538	33.1	6.0	2.0	53.8	Boiling water	
Brand C (7/56)	Flour, shortening, baking powder, salt	6.6	522	31.0	7.0	1.9	53.5	Water	

Do. (9/60)	Flour, shortening with freshness preserver, salt, baking powder.	7.0	522	31.3	7.7	1.9	52.1	Cold water	
Brand D (7/56)	Flour, shortening, salt, baking powder	6.4	509	28.2	5.5	2.2	57.7	Water	
Do. (12/60)	Flour, shortening with freshness preserver, baking powder, salt.	7.7	504	28.2	6.1	2.2	55.8	Cold water	
Brand E (8/59)	Flour, shortening, salt	6.6	514	29.7	5.4	2.5	55.8	Water	42
Do. (4/61)	do	6.4	519	30.5	6.2	2.4	54.5	do	43
Type II:									
Brand B (8/56)	Flour, shortening, salt, coloring	6.7	538	34.6	6.3	2.1	50.3	Milk	
BREADS									
BAKING POWDER BISCUITS:									
Type II:									
Brand A (8/59)	Flour, shortening, sugar, nonfat milk solids, phosphate baking powder, salt.	8.4	416	12.6	6.8	3.5	68.7	Milk	
Brand B (8/59)	Flour, shortening, dextrose, nonfat dry milk, phosphate baking powder, salt.	5.5	427	12.1	7.8	3.3	71.3	do	
CORN MUFFINS:									
Type III:									
Brand A (8/59)	Cake flour, sugar, degerminated corn meal, shortening, nonfat dry milk, leavening, salt.	4.9	440	14.8	5.4	3.2	71.1	Egg, water	
Do. (9/59)	do	5.5	439	15.0	6.0	2.9	70.6	do	
Brand C (8/59)	Enriched corn meal, shortening, flour, sugar, baking powder, salt.	7.3	419	11.4	6.1	2.6	72.6	Egg, milk	
Do. (9/59)	do	7.5	418	11.3	6.0	2.5	72.7	do	
Do. (9/60)	Degerminated yellow corn meal, flour, sugar, shortening with freshness preserver, baking powder, salt.	7.2	424	12.3	6.4	2.6	71.5	do	53
PANCAKES:									
Type III:									
Brand A—plain (8/59)	Wheat, corn, oat, rye, and rice flours; corn sugar, phosphate, salt, soda, and nonfat dry milk.	8.3	360	1.8	8.6	5.6	75.7	Milk, egg, shortening.	
Brand A—buttermilk (9/60).	Wheat flour, corn flour, dextrose, salt, dried buttermilk, phosphate, soda, cornstarch, propyleneglycol, coloring.	8.7	358	1.5	9.2	5.2	75.4	Milk, shortening, *or* egg, milk, shortening.	56, 57, 61
WAFFLES:									
Type I (8/59)	Flour, shortening, sugar, baking powder, egg yolk, nonfat milk solids, salt.	5.6	458	19.2	6.5	3.4	65.3	Water	
Do. (9/60)	do	5.7	466	21.1	7.3	3.6	62.3	do	60
YEAST ROLLS:									
Type I:									
Brand A (8/59)	Flour, shortening, sugar, nonfat milk solids, salt, dried yeast.							do	64
	Dry mix	8.6	394	5.9	11.0	2.0	72.5		
	Dried yeast	7.2	309	4.9	37.2	4.0	46.7		
	Mix, 99%, and yeast, 1%	8.6	393	5.9	11.2	2.0	72.3		
Brand B (8/59)	Flour, shortening, sugar, yeast, dry whey, salt.							Water	65
	Dry mix	8.8	399	6.9	10.6	1.5	72.2		
	Dried yeast	6.3	307	4.0	40.2	3.9	45.6		
	Mix, 98%, and yeast, 2%	8.8	397	6.8	11.2	1.6	71.6		

See footnotes at end of table.

TABLE 13.—*Proximate composition and labeled ingredients of market-purchased dry mixes*—Continued

Description of sample and date received	Ingredients [1]	Composition per 100 grams mix						Ingredients to be added	Matching prepared product (table 12)
		Moisture	Food energy	Fat	Protein	Ash	Carbohydrate (by difference)		
PIE FILLINGS									
		Grams	*Calories*	*Grams*	*Grams*	*Grams*	*Grams*		*Item No.*
CUSTARD DESSERT: Type II (8/59)	Sugar, dextrose, carragheen extract, salt, flavoring, coloring.	0.1	381	0.1	(3)	0.9	98.3	Milk	
COCONUT PIE FILLING: Type III (8/59)	Sugar, cornstarch, coconut, salt, vanilla, flavoring, coloring.	1.7	427	10.3	1.2	1.3	85.5	Milk, egg yolk.	42
Do. (4/61)	do	1.4	433	11.2	1.7	1.1	84.6	do	43
FROSTINGS									
Type I: Brand A (8/59) (chocolate butter cream).	Sugar, dextrose, cocoa, shortening, nonfat milk solids, salt, flavoring.	3.1	385	7.4	3.2	1.2	85.1	Water	
Brand B (9/59) (chocolate fudge).	Sugar, dextrose, shortening, cocoa, salt, flavoring.	.8	408	9.8	2.5	.5	86.4	Water, butter.	

[1] Ingredients are listed in descending order by weight, as given on package labels.
[2] Each box of mix yielded one 8- or 9-inch layer of cake. All other brands of this mix type yielded two 8- or 9-inch layers.
[3] Physiologically unavailable.

Brownie mixes containing egg solids (Type I) were higher in moisture, protein, and ash, and lower in fat than Type III mixes, to which eggs were added during preparation for baking. After baking, the Type I mix was still lower in fat and also slightly lower in protein than the Type III mix. The two brands of cookie mix analyzed were reasonably close in proximate composition, except that the component ash was more than 50 percent higher in brand A, the mix that contained baking powder rather than soda.

Four brands of pie crust mix, which were analyzed in both 1956 and 1960, and crust mix from a dry pack of coconut pie, analyzed in both 1959 and 1961, changed little in content of most proximate components. Protein in four of the five brands increased by about 10 percent between the 2 years.

Two brands of biscuit mix had essentially the same composition. Corn muffin mixes also showed good agreement for all proximate components but fat, which was more than 20 percent higher in brand A than in brand C.

Finished products made from mixes, except for sugar cookies, were higher in moisture content per 100 grams and lower in caloric value and carbohydrate than were the dry mixes from which they were prepared. The amount and composition of ingredients which were added to the mixes determined changes in content of fat, protein, and ash.

Other Changes in Proximate Composition With Baking

Pie crusts from baked filled pies, both homemade and made-from-mix, were usually lower in fat and higher in moisture than would be expected from calculations of percentages of fat and water used in their formulation. Similar observations were made on crusts from frozen apple and coconut pies, for which proximate data were obtained both before (table 14) and after (table12) baking. Other proximate values in these crusts, except for protein in coconut crusts, showed a corresponding decrease. Fillings of both frozen pies decreased in moisture with baking, while other proximate components, with the exception of protein in coconut filling, showed a corresponding increase. Although total weights of these forms of pies decreased because of evaporation during baking and cooling, in most instances the crusts gained in weight. As a result, the proportion of crust to filling in these pies increased with baking. It was evident that moisture shifted from fillings to crusts during the time pies were baked and cooled.

To examine the effect of baking on the pie shell alone, proximate data were obtained on one lot of homemade pie crust which had been divided; one-half was analyzed unbaked and the other half was analyzed after being baked without a filling. Moisture content dropped from 10.2 percent in the unbaked to 0.7 percent in the baked crust; fat increased from 38.2 percent in the unbaked to 41.8 percent in the baked shell. Fat in the baked crust, calculated from the amount of fat included in the dough and allowing for weight losses during baking, would be 42.8 percent. As determined by acid hydrolysis, analyzed fat content of the total baked shell, plus the very small amount (<0.1 percent) of fat remaining on the pan after baking, equaled 98 percent of the predicted value.

Moisture losses during baking in other ready-to-bake items (tables 12 and 14) were usually between 20 and 30 percent, although frozen waffles lost only 12 percent moisture during toasting and cookies baked from commercial refrigerated dough lost as much as 75 percent. Other proximate nutrients increased correspondingly in value, depending on the moisture loss.

Composition of Frosted Cakes and Brownies

Frozen and bakery devil's food and yellow cakes and frozen brownies contained butter-cream frostings as received in the laboratory. These frostings were removed and analyzed separately, thereby making it possible to calculate the total composition of frosted cakes (table 15) and to make observations on some differences in nutritive value between plain and frosted cakes. Frostings included with these cakes nearly always contained equal or greater percentages of fat and carbohydrate and less protein and ash than the matching cakes.

The proximate composition of frosted cake depends not only on the separate compositions of cake and frosting, but also on the proportions of cake to frosting in the finished product. Proportions of frosting in the total cake ranged from 25 percent of the weight in frozen brand A devil's food (which also contained 23 percent cream filling) to 49 percent in bakery yellow cake. Frozen brownies were 24 percent frosting. In this investigation, frosted cake per 100-gram portion in most instances was slightly higher in caloric value and fat and correspondingly lower in protein and ash than was plain cake. Per serving, the addition of frosting to a cake in the amounts used on these frozen and bakery cakes resulted in increases in fat, carbohydrate, and energy values ranging from 50 to more than 100 percent. The caloric value per serving of frosted cake was thus approximately equal to that for a serving of pie, and nearly three times higher than that for plain angel or plain pound cake.

TABLE 14.—*Proximate composition of ready-to-bake food items*

Description of sample and date received	100-gram portion						Individual serving by volume [1]							Matching baked product (table 12)
	Moisture	Food energy	Fat	Protein	Ash	Carbohydrate (by difference)	Weight	Moisture	Food energy	Fat	Protein	Ash	Carbohydrate (by difference)	
	Grams	*Calories*	*Grams*	*Grams*	*Grams*	*Grams*	*Grams*	*Grams*	*Calories*	*Grams*	*Grams*	*Grams*	*Grams*	*Item No.*
SUGAR COOKIES:														
Chilled in roll (8/59)	13.6	449	22.6	3.5	1.5	58.8	12	1.6	54	2.7	0.4	0.2	7.1	
Do. (9/60)	14.4	443	22.3	3.9	1.7	57.7	12	1.7	53	2.7	.5	.2	6.9	28
PIES:														
Apple:														
Frozen, Brand A (9/59):														
Crust	16.6	482	30.8	4.4	1.5	46.7	43	7.1	207	13.2	1.9	.6	20.2	
Filling	68.2	118	.1	.2	.8	30.7	64	43.6	76	.1	.1	.5	19.7	
Crust, 40%, and filling, 60%	47.6	264	12.4	1.9	1.1	37.0	107	50.7	283	13.3	2.0	1.1	39.9	
Frozen, Brand B (8/59):														
Crust	19.7	456	27.7	4.7	1.3	46.6	37	7.3	169	10.2	1.7	.5	17.3	34
Filling	72.0	106	.0	.2	.3	27.5	85	61.2	90	.0	.2	.3	23.3	
Crust, 30%, and filling, 70%	56.3	210	8.3	1.6	.6	33.2	122	68.5	259	10.2	1.9	.8	40.6	
Cherry:														
Frozen, Brand A (8/59):														
Crust	17.2	469	28.6	4.3	1.4	48.5	38	6.5	178	10.9	1.6	.5	18.5	
Filling	65.7	131	.1	.6	.4	33.2	65	42.7	85	.1	.4	.3	21.5	
Crust, 37%, and filling, 63%	47.8	256	10.6	1.9	.8	38.9	103	49.2	263	11.0	2.0	.8	40.0	
Coconut:														
Frozen, Brand A (9/59):														
Crust	17.0	460	26.7	4.9	1.5	49.9	25	4.2	116	6.7	1.2	.4	12.5	
Filling	64.2	167	6.1	2.9	.9	25.9	80	51.4	134	4.9	2.3	.7	20.7	
Crust, 24%, and filling, 76%	52.9	237	11.0	3.4	1.0	31.7	105	55.6	250	11.6	3.5	1.1	33.2	
Frozen, Brand B (8/59):														
Crust	21.7	432	24.6	4.9	1.4	47.4	32	6.9	138	7.9	1.6	.4	15.2	44
Filling	67.1	148	4.5	5.3	1.1	22.0	130	87.2	192	5.8	6.9	1.4	28.7	
Crust, 20%, and filling, 80%	58.0	205	8.5	5.2	1.2	27.1	162	94.1	330	13.7	8.5	1.8	43.9	
Pie crust:														
Shell, homemade (11/60)	10.2	544	38.2	6.3	1.3	44.0	40	4.1	218	15.3	2.5	.5	17.6	47
BREADS:														
Baking powder biscuits:														
Refrigerated, chemically leavened:														
Brand A (9/59)	37.5	277	6.4	7.2	2.4	46.5	49	18.4	136	3.1	3.5	1.2	22.8	
Brand C (8/59)	38.4	260	4.2	7.3	3.0	47.1	47	18.0	122	2.0	3.4	1.4	22.2	
Do. (9/60)	38.4	261	4.4	7.1	3.1	47.0	47	18.0	123	2.1	3.3	1.5	22.1	50
Frozen (9/59)	30.9	327	11.9	5.7	2.6	48.9	65	20.1	213	7.7	3.7	1.7	31.8	
Do. (9/60)	32.0	320	11.6	6.3	2.9	47.2	65	20.8	208	7.5	4.1	1.9	30.7	51

Pancakes:														
Frozen (8/59)	47.3	211	2.8	6.7	3.7	39.5	128	60.5	270	3.6	8.6	4.7	50.6	----
Do. (9/60)	46.3	226	5.0	5.0	3.7	40.0	128	59.3	289	6.4	6.4	4.7	51.2	58
Waffles:														
Frozen, Brand A (8/59)	42.1	253	6.2	7.0	2.6	42.1	79	33.3	200	4.9	5.5	2.1	33.2	----
Do. (9/60)	43.1	252	6.9	6.3	2.7	41.0	79	34.0	199	5.5	5.0	2.1	32.4	62
Yeast rolls:														
Frozen, Brand A (8/59)	38.0	274	5.7	7.7	1.6	47.0	30	11.4	82	1.7	2.3	.5	14.1	66
Frozen, Brand B (8/59)	38.5	268	5.0	7.5	1.6	47.4	31	11.9	83	1.6	2.3	.5	14.7	67
Brown-and-serve, Brand A (9/59)	32.0	299	5.8	9.0	1.7	51.5	29	9.3	87	1.7	2.6	.5	14.9	----
Brown-and-serve, Brand B (8/59)	33.0	299	6.8	8.0	1.7	50.5	31	10.2	93	2.1	2.5	.5	15.7	68

[1] Based on weight of serving after baking, using volume of individual serving of homemade form as reference. (See table 6.)

TABLE 15.—*Proximate composition of ready-to-serve cakes and brownies, with and without frosting [1] and filling*

Description of sample and date received	100-gram portion						Individual serving by volume [2]						
	Moisture	Food energy	Fat	Protein	Ash	Carbohydrate (by difference)	Weight	Moisture	Food energy	Fat	Protein	Ash	Carbohydrate (by difference)
DEVIL'S FOOD CAKES:													
Frozen:													
Brand A (9/59):	*Grams*	*Calories*	*Grams*	*Grams*	*Grams*	*Grams*	*Grams*	*Grams*	*Calories*	*Grams*	*Grams*	*Grams*	*Grams*
Cake	29.5	328	13.7	5.0	1.6	50.2	49	14.5	161	6.7	2.5	0.8	24.5
Frosting	18.7	408	20.8	1.9	.8	57.8	24	4.5	98	5.0	.5	.2	13.8
Filling (whipped cream)	42.3	428	41.6	1.8	.4	13.9	22	9.3	94	9.3	.4	.1	3.0
Cake, 52%; frosting, 25%; and filling, 23%.	29.7	371	21.9	3.5	1.1	43.8	95	28.3	353	20.9	3.4	1.1	41.3
Brand B (8/59):													
Cake	24.7	368	18.0	5.2	1.8	50.3	70	17.3	258	12.6	3.6	1.3	35.2
Frosting	13.8	405	16.8	2.5	1.0	65.9	36	5.0	146	6.0	.9	.4	23.7
Cake, 66%, and frosting, 34%	21.0	381	17.6	4.3	1.5	55.6	106	22.3	404	18.6	4.5	1.7	58.9
Bakery:													
Brand A (8/59):													
Cake	21.6	341	9.9	4.7	1.7	62.1	55	11.9	188	5.4	2.6	.9	34.2
Frosting (white)	15.2	402	15.4	3.4	1.0	65.0	24	3.6	96	3.7	.8	.2	15.7
Cake, 70%, and frosting, 30%	19.7	359	11.6	4.3	1.5	62.9	79	15.5	284	9.1	3.4	1.1	49.9
Brand C (9/59):													
Cake	27.3	324	11.8	5.0	1.9	54.0							
Frosting	14.7	376	13.9	2.5	.9	68.0							
Cake, 52%, and frosting, 48%	21.3	349	12.8	3.8	1.4	60.7							
YELLOW CAKES:													
Bakery (9/59):													
Cake	25.6	360	14.7	4.5	2.0	53.2	68	17.4	245	10.0	3.1	1.4	36.1
Frosting	14.2	387	14.5	2.6	.8	67.9	65	9.2	252	9.4	1.7	.5	44.2
Cake, 51%, and frosting, 49%	20.0	373	14.6	3.6	1.4	60.4	133	26.6	497	19.4	4.8	1.9	80.3
BROWNIES:													
Frozen (9/59):													
Brownie	13.1	422	21.5	5.7	1.3	58.4	23	3.0	97	4.9	1.3	.3	13.5
Frosting	10.8	408	17.7	2.3	1.2	68.0	7	.8	29	1.2	.2	.1	4.7
Brownie, 76%, and frosting, 24%	12.5	419	20.6	4.9	1.3	60.7	30	3.8	126	6.1	1.5	.4	18.2

[1] Chocolate frosting except where otherwise indicated.
[2] Volume of individual serving of homemade form of cake without frosting was used as reference. (See table 6.)

Mineral Content of Selected Dry Mixes

Of the eight minerals (calcium, copper, iron, magnesium, manganese, phosphorus, sodium, and potassium) determined in cake and brownie mixes, those found in greatest concentration were phosphorus, sodium, potassium, and sometimes calcium (table 16). These elements are the ones most likely to be contributed by baking powder, salt, soda, and other leavenings, and are found in considerably higher levels in basic ingredients (flour, milk, eggs, cocoa) than are the other minerals studied (*3, 13*).

Calcium was high in either the flour mix or the egg-white mix of angel food cake, but not in both. Phosphorus varied with the calcium for these mixes, an indication of the use of chemical leavening agents. According to Harrel (*4*), anhydrous monocalcium phosphate is included in the egg-white portion, and cream of tartar in the flour portion, of the angel food mix. Data presented here (table 16) indicate, however, that manufacturers differ in the portion of the mix to which they add the calcium phosphate, and that the flour mix which contained calcium phosphate did not, according to potassium content, also contain cream of tartar. The potassium of the egg-white mix could all have been contributed by potassium in the egg white, assuming the mix contained 31 percent egg albumin (*4*).

TABLE 16.—*Mineral content of cake and brownie mixes, as purchased*

Description of sample and date received	Total solids	Element content per 100 grams of mix							
		Ca	Mg	P	Cu	Fe	Mn	Na	K [1]
ANGEL FOOD CAKE:									
Brand A (9/59):	*Percent*	*Mg.*	*Mg.*	*Mg.*	*Mg.*	*Mg.*	*Mg.*	*Mg.*	*Mg.*
Flour mix	98.0	20	10	(2)	0.11	0.4	0.2	116	75
Egg mix	98.3	202	21	247	.12	.4	(2)	270	277
Brand B (9/59):									
Flour mix	98.0	186	10	251	.11	.5	.2	200	26
Egg mix	98.6	35	24	(2)	.10	.5	(2)	265	246
DEVIL'S FOOD CAKE:									
Brand A (9/59)	96.9	35	37	172	.28	2.1	.3	514	139
POUND CAKE:									
Brand C (8/59)	97.1	20	9	133	.10	.7	.3	284	43
YELLOW CAKE:									
Brand A (9/59)	97.4	143	12	275	.11	.8	.3	415	78
Brand B (9/59)	96.5	136	10	242	.12	1.4	.3	350	89
BROWNIES:									
Type I (9/59)	97.0	21	46	105	.30	1.2	.4	299	163
Type III:									
Brand A (9/59)	97.8	69	63	124	.41	2.5	.5	158	167
Brand B (8/59)	97.6	17	41	100	.71	1.2	.3	230	131

[1] Flame photometer determination.
[2] Below the level detectable on the spectrograph.

Calcium was low in the devil's food cake mix which, according to the label, contained nonfat milk solids. The protein and calcium contents of this mix indicated the amount of milk solids present was low. Calcium levels in yellow cake mixes were four times that of the one devil's food mix. Magnesium, copper, iron, and potassium were high in the mixes containing cocoa. Manganese levels were low and varied little among the mixes.

Although commercial cakes as a whole contained more ash than corresponding homemade items, cakes made from mixes, except for devil's food, contained amounts of total ash equal to or less than the homemade. The content of the four major minerals in homemade and made-from-mix cakes and brownies was estimated from data for the sodium, potassium, calcium, and phosphorus content of individual ingredients (*3*, *13*) and from data reported in table 16 for the mineral content of the mixes. As calculated, mix angel food cakes, which depended on calcium phosphate for leavening, were considerably higher in calcium and phosphorus and lower in potassium than the homemade cake; estimated values for calcium in the homemade, brand A, and brand B made-from-mix cakes were 6, 53, and 104 mg., respectively, per 100 grams baked cake. Corresponding potassium values were 21, 53, and 129 mg. Of the mixes studied, only the devil's food cake (381 mg.) was equal to the homemade form (389 mg.) in sodium content of 100 grams baked cake; other mixes were considerably lower in sodium than were the homemade items. Sodium in the homemade cake could be adjusted, of course, by decreasing the salt content or changing the kind of baking powder.

On the average, cakes and brownies made from mixes were about equal to homemade in calcium and phosphorus content and contained about two-thirds the sodium and potassium levels of the homemade. Average values for the homemade and made-from-mix items, in milligrams per 100 grams baked weight, were, respectively, calcium, 57 and 69; phosphorus, 126 and 154; sodium, 366 and 232; and potassium, 174 and 123.

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